SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES - Part VI

SPECIAL SCIENTIFIC REPORT: FISHERIES No. 39

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

Explanatory Note

The series embodies results of investigations, usually of restricted scope, intended to aid or direct management or utilization practices and as guides for administrative or legislative action. It is issued in limited quantities for the official use of Federal, State or cooperating agencies and in processed form for economy and to avoid delay in publication.

Washington, D. C.
October 1950

United States Department of the Interior
Oscar L. Chapman, Secretary
Fish and Wildlife Service
Albert M. Day, Director

Special Scientific Report - Fisheries

No. 39

SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES

Part 6

Area V - Snake River system from the mouth through the Grande Ronde River

By

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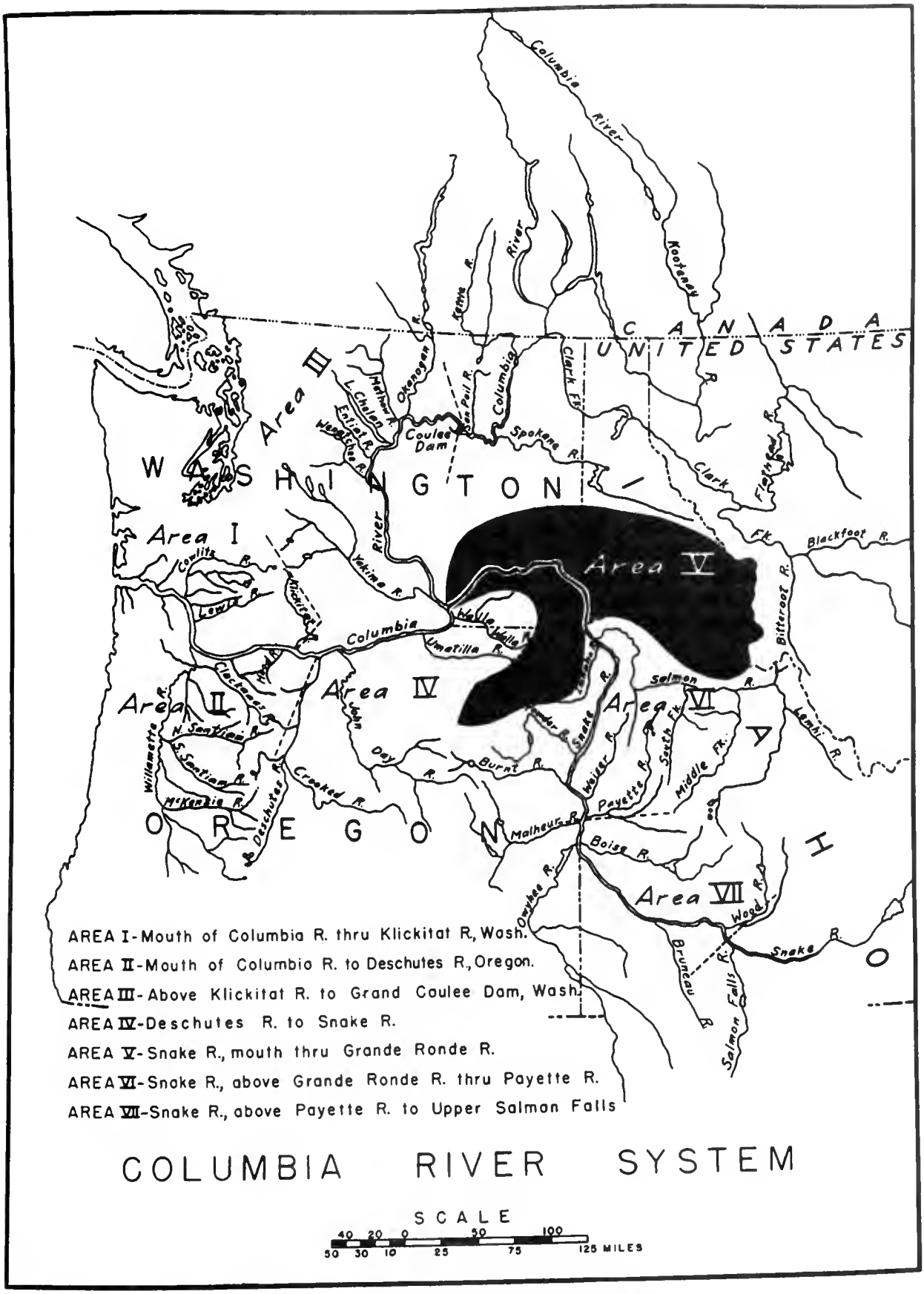
CONTENTS

ILLUSTRATIONS



AREA I-Mouth of Columbia R. thru Klickitat R, Wash.
AREA II-Mouth of Columbia R. to Deschutes R., Oregon.
AREA III-Above Klickitat R. to Grand Coulee Dam, Wash.
AREA IV-Deschutes R. to Snake R.
AREA V-Snake R., mouth thru Grande Ronde R.
AREA VI-Snake R., above Grande Ronde R. thru Payette R.
AREA VII-Snake R., above Payette R. to Upper Salmon Falls

COLUMBIA RIVER SYSTEM

SCALE

40 20 0 50 100
50 30 10 25 75 125 MILES

Figure 1.--Columbia River System

INTRODUCTION

The purpose of the Columbia River Stream Survey has been to provide data for the evaluation of each stream, or portion of stream, from the standpoint of its present and potential value in relation to the maintenance of the salmon resources of the Columbia River. The Columbia River watershed has been divided into several survey areas or units. This report deals with the streams in Area V, as shown in Figure 1.

Area V includes the lower Snake River and its tributaries from the mouth to the confluence of the Grande Ronde River, a distance of approximately 170 miles along the Snake River. The major tributaries of possible value to salmon in this area are the Tucannon, Asotin, Clearwater, and Grande Ronde Rivers. This area was formerly of great importance in the production of chinook, silver, and blueback salmon and steelhead trout. Its productivity has been greatly reduced as a result of the construction of dams and the diversion of water for irrigation and power. The runs of blueback salmon have been exterminated, but the area still retains some value as a producer of the other species. In addition, the main stem of the Snake River in this area is an important migration route to spawning and rearing areas farther upstream.

Various individuals have had a part in the field work and, so far as possible, the names of those who made the observations upon which the following account is based and the dates on which the surveys were made are given in connection with the treatment of each stream. For convenience a complete list of the men who were engaged in the survey of Area V is given herewith: F.G. Bryant, R.E. Burrows, L.S.Christey, D.G. Frey, M.G. Hanavan, W.M. Morton, Z.E. Parkhurst, R.F. Shuman, A.J. Suomela, J.L. Wilding, and P.D. Zimmer.

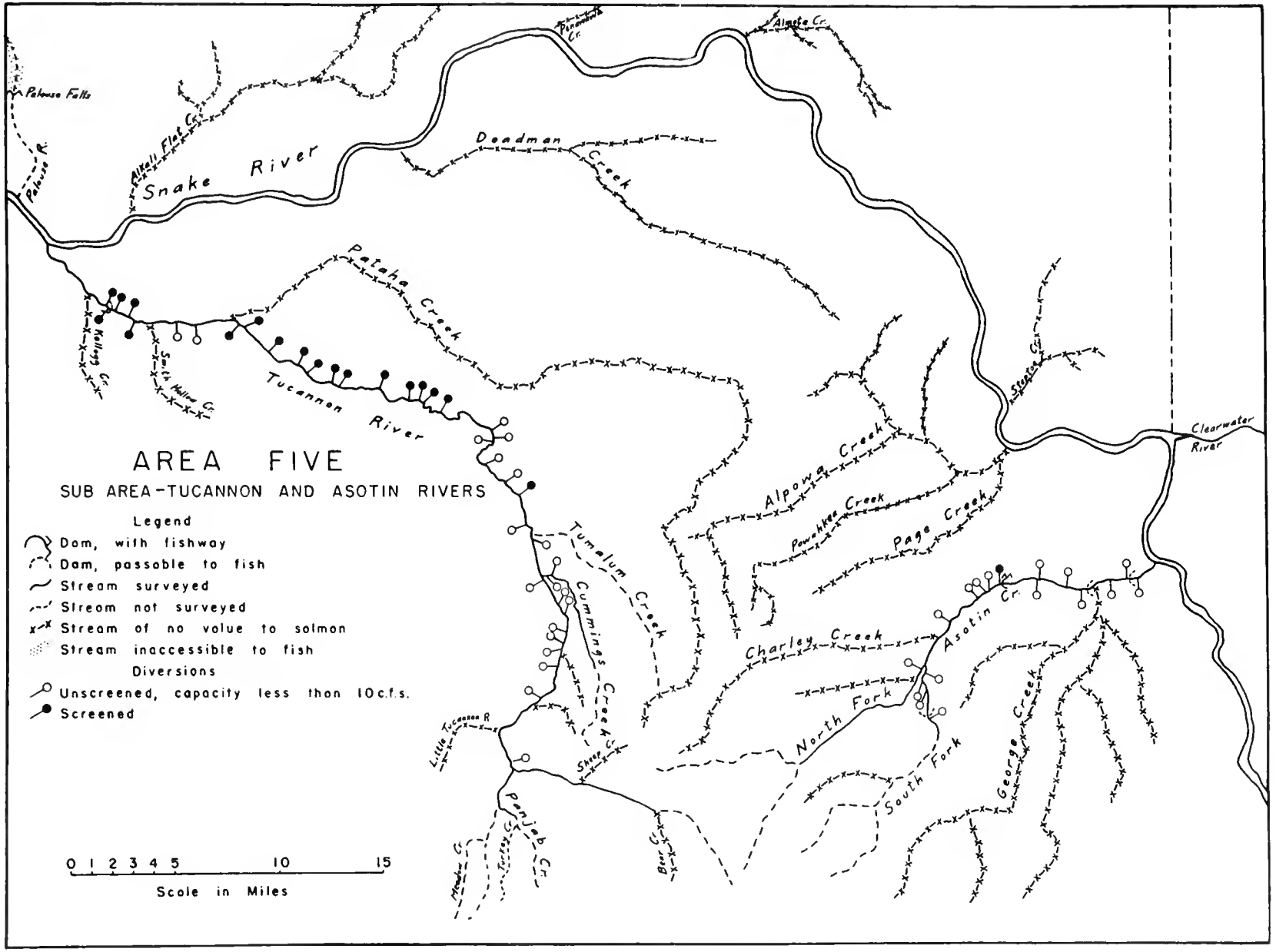


Figure 2.--Tucannon and Asotin River Systems

PART 1

MAIN SNAKE RIVER AND TRIBUTARIES

(Exclusive of sub-areas)

List of Streams

The Survey

Main Snake River.-- The Snake River joins the Columbia River approximately 324 miles above the mouth. It is the largest tributary to the Columbia River, extending for a distance of more than 1,000 miles. It flows through southeastern Washington, forms part of the western boundary of Idaho, and extends through southern Idaho to the continental divide in Wyoming. Its drainage area comprises more than 109,000 square miles. Gaging station records for the water-years 1909-1935, taken at a station 68 miles above the mouth, show discharges ranging from a maximum of 270,000 c.f.s. in May to a minimum of 10,600 c.f.s. in August and September. The mean discharge was 49,070 c.f.s. The flood of June, 1894 reached a crest of about 409,000 c.f.s. near the same station, and the flood of May, 1948 reached a peak of 368,000 c.f.s. near Clarkston, 134 miles above the mouth. The discharge at the mouth is somewhat higher than these figures, but reliable data are not available.

From the mouth to Lewiston, Idaho, a distance of approximately 140 miles, the Snake River has a moderate gradient and some extensive spawning areas.

1. Palouse River.-- (Not surveyed) The Palouse River enters the Snake River approximately 60 miles above the mouth. It is a large river about 150 miles long. A high falls located about 6 miles above the mouth renders the stream inaccessible to migratory fish.

2. Tucannon River.-- (February 2-8,1935, and June 18-19, 1935; Suomela, Shuman, and Burrows.) The Tucannon River enters the Snake River approximately 63 miles above the mouth. The stream is about 60 miles long, of which the lower 53 miles were surveyed. Near the mouth the stream had an average width of 50-60 feet. The discharge at the mouth on February 2, 1935 was 180 c.f.s. Gaging-station records for the period of September, 1913 through September, 1914, taken at a station 25 miles above the mouth show discharges ranging from a maximum of 294 c.f.s. in April and May, to a minimum of 59 c.f.s. in August. The water temperature ranged from 36°F. to 43°F. in February, and from 44°F. to 53°F. in June. The gradient is moderate in the lower 49 miles, and becomes fairly steep in the upper 4 miles of the section surveyed. There are numerous good shallow riffles and an adequate number of resting pools well distributed throughout the stream course. It was estimated that there were 1,091,000 sq. yd. of medium and small rubble, constituting 94 percent of the total bottom in the section surveyed. A significant portion of the medium and small rubble constituted excellent salmon spawning area.

It is difficult for fish to enter the Tucannon River at low water stages because of a delta that has been formed at the mouth by flood action. This section is in need of channel improvement.

The power and irrigation diversion dam near Starbuck, Washington, approximately 5½ miles above the mouth, is a barrier at low water to the upstream migration of fish. Almost the entire flow at low water stages is taken by the power diversion, and consequently the main attraction to fish is at the tailrace of the power plant. The 1 mile section of river channel between the intake and the power house tailrace is virtually dry during the summer months. The diversion at this point on February 3, 1935, was 66½ c.f.s., of which 55½ c.f.s. was used for power and 11 c.f.s. for irrigation. The diversion has been screened by the Washington State Fisheries Department.

The upper De Ruwe dam, located approximately 16 miles above the mouth, is a barrier to fish at low water. This dam is about 5 feet high, and is reported to block at least part of the chinook run. The dam was originally built to supply water for a power diversion, but is now used to supply an irrigation diversion. An old fish ladder at one end of the dam was filled with mud and debris and overgrown with willows at the time of the survey, and was entirely useless. At the time of the survey (February 1935) there was considerable discharge over the spillway, and only 2 c.f.s. were being diverted into the irrigation canal. During the summer irrigation season dam boards are placed across the 10 foot wide spillway crest, and most of the flow is diverted into the unscreened irrigation ditch.

A total of 31 diversions withdrawing 128 c.f.s. were found on the Tucannon River. Irrigation ditches were taking 72 c.f.s., and the remainder was being used for power. It was reported that three of these ditches have been screened by the Washington State Fisheries Department. The total amount of water diverted during the irrigation season was not determined, as many temporary wing dams are then installed. It is doubtful if by-passes are used to return irrigation water to the main river during the irrigation season. There is also little ground return from these ditches in this semi-arid region.

Steelhead trout appear in the Tucannon in January, February, March, and April, with a small fall run also reported. A considerable run of steelhead still entered the river at the time of the survey (1935), although these fish were not nearly as abundant as in earlier years.

The last large run of chinook salmon was reported to have occurred in 1915. It was reliably estimated that at that time an average of 500 salmon per day entered the river during the spawning migration, which lasts through May and June. At the time of the survey it was reported that an average of 50 salmon per day entered the stream during the spawning migration, or a total of approximately 3,000 fish. It was reported that chinook salmon spawning is at its peak about the middle of August. Until 1922 or 1923 a run of chinook salmon also was reported to enter the stream in the fall months. Apparently this run also has been greatly depleted.

The last run of silver salmon that was observed to enter the stream occurred in October, 1929. A small number of these fish probably still appear.

In 1938 the Columbia River Investigation made an attempt to determine the size of the chinook run in the Tucannon River. A counting weir was installed at a point 2 miles above the mouth, but recurrent flash floods washed it out on several occasions, preventing an accurate count. However, it was shown that the run had been depleted to a negligible size. Only 24 chinook salmon were observed to pass through the weir, and later a careful check of the stream failed to disclose any spawning activity. It was reported that a total of 26 chinook salmon were taken by sports fishermen during the same season.

The Tucannon is apparently of little value as a salmon producer at present. However, it has excellent potential value, and could support a good run if provisions were made for the passage of fish over existing obstructions, and all diversions were adequately screened to prevent the destruction of downstream migrants.

2A. Kellogg Creek.— (February, 1935; Suomela and Burrows.) Kellogg Creek enters the Tucannon River at Starbuck, 4 miles above the mouth. The stream is small and intermittent, and of no value to migratory fish.

2B. Smith Hollow Creek.— (February, 1935; Suomela and Burrows.) Smith Hollow Creek enters the Tucannon River about 8 miles above the mouth. The stream is small and intermittent, and of no value to migratory fish.

2C. Pataha Creek.— (April 28, 1937; Suomela and Burrows.) Pataha Creek enters the Tucannon River approximately 11 miles above the mouth. The stream is about 35 miles long. At the time of observation it was discharging about 4 c.f.s. It was reported that the stream nearly always becomes dry during the summer. There are no runs of migratory fish into Pataha Creek, and it is of no potential value to them.

2D. Tumalum Creek.— (June 18, 1935; Suomela and Shuman.) Tumalum Creek enters the Tucannon River approximately 32½ miles above the mouth. It is a small stream, and of no value to migratory fish.

2E. Cummings Creek.— (June 18, 1935; Suomela and Shuman.) Cummings Creek enters the Tucannon River approximately 34 miles above the mouth. The stream is about 12 miles long, of which the lower 6 miles were surveyed. It is too small and steep above the terminus of the survey to be of value to salmon. At a point 2½ miles above the mouth the stream was 10 feet wide and flowing at a rate of about

8 c.f.s. The water temperature ranged from 47°F. to 53°F. The gradient is moderate in the lower 5 miles, and becomes steep in the upper section. There are numerous shallow riffles and small pools throughout the section surveyed. It was estimated that there were 23,000 sq. yd. of medium and small rubble constituting 74 percent of the stream bed in the section surveyed. A large part of the stream bed provides excellent spawning area.

Two small irrigation diversions were found on Cummings Creek. The first, located about 1/2 mile above the mouth, was not in use at the time of inspection but had a capacity of about 2 c.f.s. The second, located about a mile above the mouth, was withdrawing about 2 c.f.s. There were no fish protective devices. The wing dams in connection with these diversions were not barriers to fish.

Cummings Creek formerly supported a good chinook salmon population, but there has been no chinook run in recent years. A good spring run of steelhead trout still enters the stream, and there is also a large population of resident rainbow trout in the upper section. The stream is of excellent potential value to salmon.

2F. Watermelon Creek.— (June 18, 1935; Suomela and Shuman.) Watermelon Creek enters the Tucannon River approximately 39 miles above the mouth. It is a small, short stream, and of no value to salmon.

2G. Grub Canyon Creek.— (June 18, 1935; Suomela and Shuman.) Grub Canyon Creek enters the Tucannon River approximately 41½ miles above the mouth. It is a small, short stream, and of no value to salmon.

2H. Little Tucannon River.— (April 28, 1937; Suomela and Burrows.) The Little Tucannon River enters the Tucannon River approximately 44 miles above the mouth, and extends for about 6 miles. It has a steep gradient with many cascades, and a stream bed composed chiefly of large rubble and boulders. The discharge was about 4 c.f.s. at the time of observation. Because of its small size and lack of good spawning area the stream is of little possible value to salmon or steelhead.

2I. Panjab Creek.— (June 19, 1935; Suomela and Shuman.) Panjab Creek enters the Tucannon River approximately 46 miles above the mouth. The stream is about 8 miles long, of which the lower 4 miles were surveyed up to the mouth of Turkey Creek. Above this point the stream was flowing less than 5 c.f.s., and was too small and steep to be of more than slight possible value to salmon. The stream was 19 feet wide at the mouth, and was discharging about 60 c.f.s. The gradient is fairly steep and the velocity is high, being 3-4 feet per second throughout the section surveyed. The water temperature ranged from 45°F to 49°F. There are many fast riffle areas, and

numerous good large resting pools. It was estimated that there were 22,000 sq. yd. of medium and small rubble constituting 75 percent of the stream bed in the section surveyed. There are no obstructions or water diversions. Rainbow trout are abundant and a good spring run of steelhead trout is reported. Panjab Creek appeared to be more suitable for trout than for salmon, and it was reported that salmon did not enter the stream.

2I-(1). Meadow Creek.— (June 19, 1935; Suomela and Shuman.) Meadow Creek enters Panjab Creek approximately 2½ miles above the mouth and extends for approximately 7 miles. It was 18 feet wide at the mouth and discharging about 35 c.f.s. at the time of observation. It is similar in character to Panjab Creek.

2I-(2). Turkey Creek.— (June 19, 1935; Suomela and Shuman.) Turkey Creek enters Panjab Creek approximately 4 miles above the mouth and is about 4 miles long. At the time of observation it was discharging about 20 c.f.s. It is similar in character to Panjab Creek.

2J. Sheep Creek.-- (June 19, 1935; Suomela and Shuman.) Sheep Creek enters the Tucannon River approximately 50½ miles above the mouth. It is a small, short stream, and of no value to salmon.

2K. Bear Creek.-- (June 19, 1935; Suomela and Shuman.) Bear Creek enters the Tucannon River approximately 53 miles above the mouth. It is a small, short stream, and of no value to salmon.

There are a number of small intermittent streams entering the Snake River in the 77 mile section between the mouths of the Tucannon and Clearwater Rivers. None of these is of any value to salmon. They include the following five streams:

3. Alkali Flat Creek.-- Enters the Snake River approximately 67 miles above the mouth, at Riparia, Washington.

4. Deadman Creek.-- Enters the Snake River approximately 85 miles above the mouth.

5. Penawawa Creek.-- Enters the Snake River approximately 93 miles above the mouth.

6. Almota Creek.— Enters the Snake River approximately 105 miles above the mouth.

7. Steptoe Creek.-- Enters the Snake River approximately 129 miles above the mouth.

8. Alpowa Creek.-- (April 26, 1937; Suomela and Burrows.) Alpowa Creek enters the Snake River approximately 131 miles above the mouth. The stream is about 22 miles long, of which the lower 11 miles were inspected. The stream had an average width of 8 feet in the section observed, and was flowing about 15 c.f.s. near the mouth at the time of observation. There is often no flow in the lower section during the summer months, due to the diversion of water into several small, unscreened irrigation ditches, and also due to the semi-arid nature of the watershed. The water temperature was 73°F. at a point near the mouth. The gradient is moderate in the lower valley portion of the course, and becomes steep in the upper canyon portion. Riffle areas are found throughout, but pools are lacking in the lower section. There is practically no stream cover in the lower part, and it is sparse in the upper portion. Stream improvement work of deepening and straightening the channel in the lower section for the purpose of flood control has contributed to rendering that part of the stream of no value to fish. The upper section is spring-fed, and never becomes completely dry. It was reported that this section supports a small resident trout population, as well as a small spring run of steelhead. Alpowa Creek is of no present or potential value to salmon.

8A. Page Creek.-- (April 26, 1937; Suomela and Burrows.) Page Creek enters Alpowa Creek about one mile above the mouth. It is a small, intermittent stream, and of no value to migratory fish.

8B. Powahkee Creek.— (April 26, 1937; Suomela and Burrows.) Powahkee Creek enters Alpowa Creek 3 miles above the mouth. It is a small, intermittent stream, and of no value to migratory fish.

9. Clearwater River.-- See Part 2, page 16

10. Asotin Creek.-- (March 8-10, 1935; Suomela and Christy.) Asotin Creek enters the Snake River approximately 146 miles above the mouth. The main stream extends for a distance of about 14½ miles, where it is formed by the confluence of the north and south forks. It was completely surveyed. In March, 1935, the stream had an average width of about 30 feet near the mouth. Gaging station records taken at a point about 10 miles above the mouth indicated a flow of 40 c.f.s. on March 10, 1935. Records for the water year 1944-45 (U.S.Geological Survey) give a maximum flow of 152 c.f.s. in May and a minimum flow of 23 c.f.s. in August. The water temperature at the time of the survey was uniformly 44°F. The stream gradient is moderate, with numerous good shallow riffles forming extensive spawning areas, and an adequate number of good resting pools well distributed throughout the course. There were estimated to be 168,000 sq. yd. of medium and small rubble constituting 79 percent of the total bottom. A large part of this medium and small rubble comprised suitable salmon spawning area.

There were two permanent dams and thirteen irrigation diversions on the main stream at the time of the survey. The first permanent dam is located about 4 miles above the mouth. It is about 2 feet high, and was installed by a former County Game Commission to prevent the migration of suckers from the Snake River into Asotin Creek. This dam does not prevent the migration of steelhead during high water, but during periods of extreme low water during the summer months it is doubtful if salmon and trout are able to pass above this obstruction. The other permanent dam is that of the Washington Water Power Company, located approximately 7½ miles above the mouth. This dam is 6 feet high, and is used for irrigation and as a source of domestic water supply for the towns of Clarkston and Asotin. No water has been diverted for power for many years. The amount of water diverted here for present uses ranges from a minimum of 10 c.f.s. to a possible maximum carrying capacity of 40 c.f.s. On March 8, 1935, it was estimated by the difference in flow measurements above and below the point of diversion that 24 c.f.s. was being withdrawn. The intakes to the diversion pipe line are adequately screened with 1/4 and 1/8 inch mesh screens to prevent the loss of downstream migrants. In periods of extremely low water this dam diverts the entire stream flow, leaving the stream bed dry except for the deep pools along the course. During the month of August, 1934, the State of Washington found it necessary to perform considerable fish salvage work in the area below the dam. Three miles of ditches were dug in this dry area connecting the various pools. Fish seining methods were also used, and in this manner it was estimated that 250,000 steelhead fingerlings and 25 adult chinook salmon spawners were saved from destruction. A fish ladder has been installed at the dam under the direction of the Washington State Department of Game. Most of the steelhead trout ascending at high water jump directly over the dam, and rarely use the ladder. It is doubtful if chinook salmon are always able to ascend the stream and pass above the dam because at the time of their appearance, later in the summer, most of the water is being diverted. The efficiency of the ladder depends on the amount of water discharged through it. Normally it provides little attraction to upstream migrants. The twelve other irrigation diversions on the main stream were not in use at the time of observation, and the amount of water withdrawn by them during the irrigation season was not determined. Most of them are small open ditches, but several use temporary wing diversion dams. None of them was provided with screens to prevent the loss of downstream migrants.

Asotin Creek formerly supported excellent runs of chinook salmon and steelhead trout. At present it has a good spring run of steelhead trout and a very samll summer run of chinook salmon. Most of the steelheads ascend the north fork, although a few enter the smaller tributaries and some spawn in the main stream. In 1936 at the peak of the steelhead run 56 steelhead were counted jumping over the old power dam in an elapsed time of 5 minutes. The stream is of

little present value as a salmon producer, the twenty five chinook spawners that were rescued and placed above the dam in 1934 probably constituting the entire run of that species. However, it has considerable potential value for salmon, as indicated by the remarkable extent to which the steelhead run has been able to survive. In order to re-establish a run of salmon in the stream it would merely be necessary to regulate the flow of water over the old power dam so as to provide a passageway for the adult fish and maintain a sufficient flow for the passage of the downstream migrants. The hazards to all the fish populations would be greatly reduced by the screening of all the water diversions. The stream is a valuable producer of steelhead trout. The value of this species has been increasingly recognized in recent years, and the stream warrants protective measures from the standpoint of the steelhead population alone.

10A. George Creek.-- (April 27, 1937; Hanavan.) George Creek enters Asotin Creek 3½ miles above the mouth and extends for about 25 miles. At the time of observation it was discharging about 35 c.f.s., which was practically flood stage. In the late summer the stream becomes nearly dry in the lower section, although it always maintains some flow. The water temperature at the mouth was 46°F. The gradient is fairly steep, especially in the upper section. The water was turbid at the time of observation, due to spring freshets, and therefore a good evaluation could not be made of the stream bed. However, there are numerous good shallow riffle areas suitable for spawning, and a few large resting pools. There is little stream cover in the lower 2 miles, but upstream the course extends through narrow, rocky canyons bordered by pine forests, providing increasingly better stream protection.

Due to the low water conditions in summer George Creek is of little possible value to salmon. A few steelhead spawners may utilize the stream, but its chief value is for resident trout, which are numerous in the upper reaches.

10B. Charley Creek.-- (April 25, 1937; Hanavan.) Charley Creek enters Asotin Creek approximately 13 miles above the mouth and extends for about 15 miles. At the time of observation it had an average width of 8 feet, and was discharging about 10 c.f.s. The flow was reported to drop to about 5 c.f.s. during the summer months, and is maintained by numerous springs in the headquarters. The water temperature was 56°F. at a point near the mouth. The gradient is fairly steep throughout the course, with some cascades. There are some good riffles and many small patches of spawning area, especially in the lower 4 miles. The stream bed was estimated to consist of 50 percent large rubble, 40 percent medium rubble, and 10 percent small rubble and gravel. The entire course extends through narrow, steep-walled canyons, with good cover along the banks. A small unscreened irrigation ditch near the mouth diverts about 1/2 c.f.s.

It was reported that no salmon ascend Charley Creek. A small run of steelhead enters the stream, and four of these fish were observed at a point about 5 miles above the mouth. It is a heavily fished stream, and produces fair catches of small rainbow trout, many of which are probably young steelheads. Numerous trout fingerlings were observed. The stream is apparently of value only to resident trout and steelhead, and it is not big enough to support a large steelhead population.

10C. North Fork, Asotin Creek.-- (June 29-30, 1936, Suomela and Burrows; April 27, 1937, Hanavan.) The North Fork joins the South Fork to form main Asotin Creek at a point approximately 14½ miles above the mouth of the latter stream. The North Fork is about 13 miles long, of which the lower 9½ miles were surveyed. At the time of the survey in June, 1936, the stream had an average width of about 24 feet in the lower 9 miles, and was discharging about 30 c.f.s. at the mouth. The water temperature ranged from 64° to 54°F. The gradient is moderate to fairly steep, increasing rapidly in the last 1/2 mile surveyed upstream. There are numerous good resting pools and extensive shallow riffle areas. There were estimated to be 93,000 sq. yd. of medium and small rubble constituting 72 percent of the total bottom in the section surveyed. A large part of this medium and small rubble comprised suitable spawning area. Approximately 9 miles above the mouth the stream is formed by the confluence of three forks, all about the same size. The survey was continued for 1/2 mile up the best appearing fork, the gradient increasing and the amount of possible spawning area decreasing rapidly upstream.

The North Fork provides the principal spawning area for the run of steelhead trout that ascends Asotin Creek. A number of steelhead were seen at the mouth on April 27, 1937, but no count of the population was obtainable. The run of chinook salmon has been depleted almost to the point of extinction, due to the previously mentioned conditions on lower Asotin Creek. The stream is of considerable present value to steelhead and resident trout, and is also of some potential value to salmon.

10C-(1). Lick Creek.-- (Not surveyed) Lick Creek enters the North Fork of Asotin Creek approximately 1 mile above the mouth. It is a small stream, becoming nearly dry during the summer. It is of no importance to migratory fish.

10D. South Fork, Asotin Creek.-- (March 8-10, 1935; Suomela and Christy.) The South Fork joins the North Fork to form main Asotin Creek at a point approximately 14½ miles above the mouth of the latter stream. The South Fork is about 12 miles long, of which the lower 4 miles were surveyed. At the time of the survey the stream had an average width of 10 feet in the lower section,

and was discharging 5 c.f.s. The water temperature was 36.5°F. at the upper terminus of the survey. The gradient is moderate to fairly steep, with numerous small falls and cascades. Small shallow riffles providing a limited amount of good spawning area were found to begin at a point about 1/2 mile above the mouth and continuing upstream, interspersed with pools and cascades. It was estimated that there were 17,500 sq. yd. of medium and small rubble, constituting 74 percent of the total bottom in the section surveyed. A large part of this medium and small rubble comprised suitable salmon spawning area.

There are four small irrigation diversions on the South Fork. None was in use at the time of observation, and none was provided with screens to prevent the loss of fish.

A log jam 4 feet high was found about 1 mile above the mouth. This jam was considered to be a barrier to fish except at high water stages.

The South Fork formerly supported a good run of steelhead trout and a reasonably good run of chinook salmon for the small size of the stream. It was reported that in recent years no chinooks have been seen in the stream, and it is probable that the salmon have been exterminated, due mainly to conditions in lower main Asotin Creek. Still more recently the steelheads have become very scarce. Resident trout are numerous, excellent catches of rainbow and Dolly Vardens being reported. The screening of the irrigation diversions, the removal of the log jam, and some other slight stream improvements would enable the stream again to support a good run of steelhead trout.

11. Tenmile Creek.-- (April 26, 1937; Hanavan.) Tenmile Creek enters the Snake River approximately 151 miles above the mouth and extends for about 20 miles. At the time of observation it was discharging about 6 c.f.s. at the mouth. During the summer months it is practically dry except for a few permanent pools. The water temperature was 65°F. at the mouth. The stream course extends almost entirely through a narrow, rocky canyon. The gradient is uniformly steep, with cascades instead of riffle areas. The stream bed is composed mainly of large and medium rubble, with practically no suitable salmon spawning area. Tenmile Creek is of no present or potential value to salmon, and it is questionable whether it is of any value to steelhead trout. Some resident trout and rough fish are found in the permanent pools.

12. Couse Creek.-- (April 26, 1937; Hanavan.) Couse Creek enters the Snake River approximately 158 miles above the mouth and extends for about 10 miles. At the time of observation it was discharging about 3 c.f.s. at the mouth, but during the summer months it becomes practically dry. The gradient is steep, and the stream

bed is composed chiefly of large and medium rubble. There are few good pools, and practically no suitable salmon spawning areas. There are no runs of salmon or steelhead into Couse Creek, and it is of no present or potential value to anadromous fish.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream and Type of Obstruction or Diversion	Height in Feet	Diversion in c.f.s.	Existing Protective Devices
PALOUSE RIVER			
Falls	16½	-	None
TUCANNON RIVER			
Starbuck dam and diversion	5	66+	Screened
Irrigation diversion	-	2.0	None
" "	-	1.8	"
" "	-	0 (dry)	"
Irrigation dam and diversion	1½	2.9	"
Irrigation diversion	-	3.3	"
" "	-	5.6	"
" "	-	6.0	Screened
Irrigation dam and diversion	5	2.0	None
Irrigation diversion	-	0.6	"
" "	-	1.5	"
" "	-	2.0	Screened
" "	-	3.8	None
" "	-	6.2	"
" "	-	0.2	"
" "	-	0.2	"
" "	-	1.2	"
" "	-	2.0	"
" "	-	0 (dry)	"
" "	-	0.5	"
" "	-	6.2	"
" "	-	6.1	"
" "	-	0.7	"
" "	-	1.0	"
" "	-	3.7	"
" "	-	0.8	"
" "	-	0.8	"
" "	-	0.4	"
" "	-	0.6	"
" "	-	1.0	"
" "	-	-1.0	"
CUMMINGS CREEK			
Irrigation diversion	-	0 (dry)	None
" "	-	2.0	"
ASOTIN CREEK			
Dam	2	-	-
Irrigation and domestic water supply dam	6	10-40	Screened; Ladder
Irrigation diversions (12 not in use)	-	0 (dry)	None
SOUTH FORK, ASOTIN CREEK			
Irrigation diversions ..... (4 - small, not in use)	-	0 (dry)	None
Log jam	4	-	-

PART 2

SUB-AREA CLEARWATER RIVER SYSTEM

Introduction

The Clearwater River joins the Snake River at Lewiston, Idaho, approximately 140 miles above the confluence of the latter stream with the Columbia River. Its watershed includes a large part of northcentral Idaho from the Snake River, which forms part of the western boundary of the state, to the crest of the Bitterroot Mountains forming the eastern boundary with Montana, and includes an area of about 10,000 square miles. The main stream system, including the three major forks and the Lochsa and Selway Rivers, extends about 500 miles.

The Clearwater River system formerly supported large runs of chinook and silver salmon and steelhead trout. These runs have been greatly depleted in recent years, and the silver run has been completely exterminated. The Clearwater has vast potential salmon producing capacity, and it was intended that this stream system be given a high priority in any program for salmon rehabilitation in the Snake River basin.

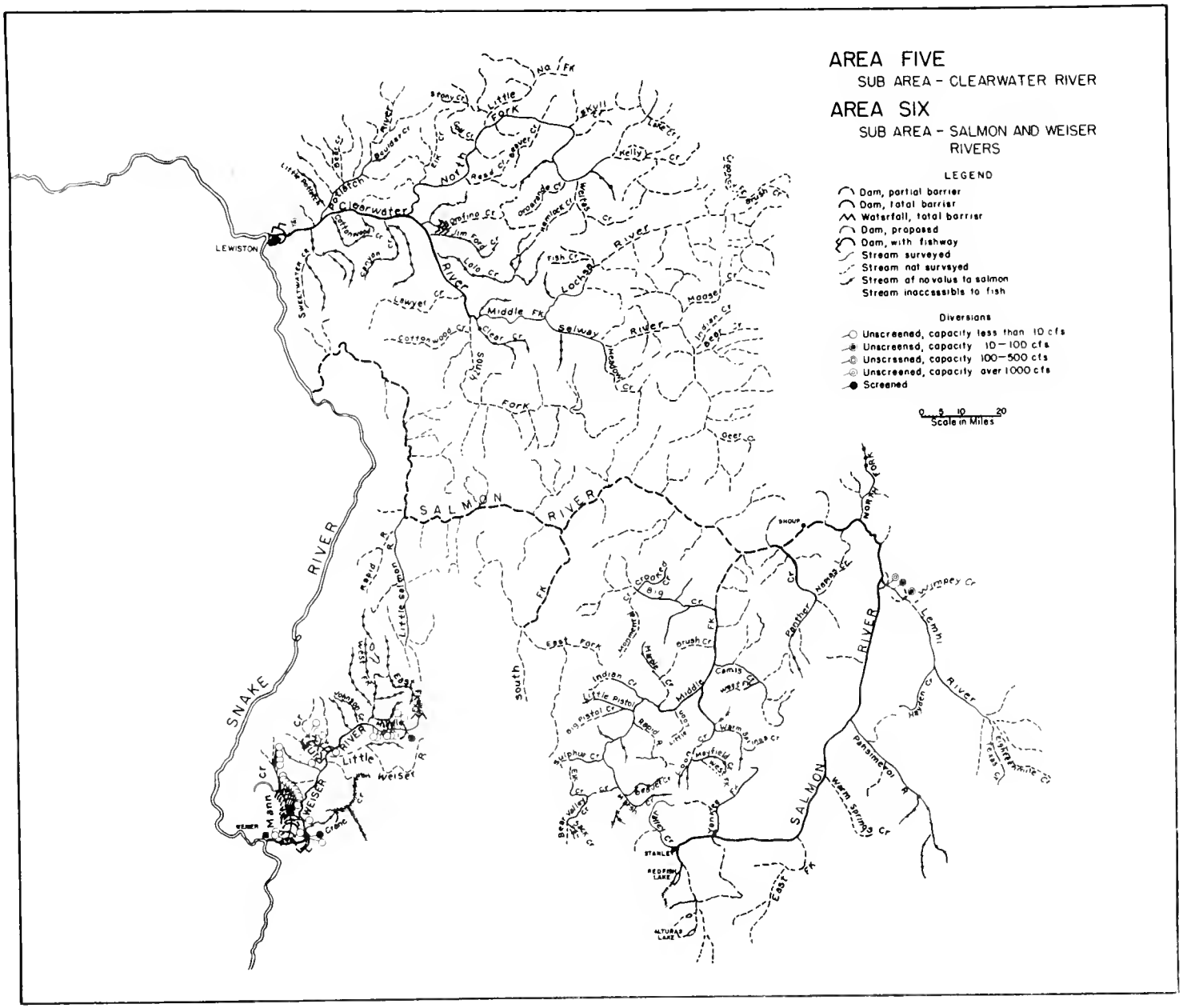


Figure 3.--Clearwater, Salmon, and Weiser River Systems

List of Streams

Figure 4.-- Power dam near the mouth of the Clearwater River at Lewiston, Idaho.

9. Main Clearwater River.— (September 15-23, 1938; Hanavan and Wilding.) The main Clearwater River extends for approximately 75 miles to the town of Kooskia, Idaho, where it is formed by the confluence of the middle and south forks. The river was 900 feet wide at the mouth and 300-400 feet wide throughout most of its course. Gaging station records for the years 1926 to 1948 taken at Spalding, Idaho, approximately 12 miles above the mouth, show discharges ranging from a maximum flood of 177,000 c.f.s. in May, 1948, to a minimum of less than 500 c.f.s. in January, 1937. The average discharge for a 19 year period (1926-1945) was 13,720 c.f.s. according to U.S. Geological Survey records. The water temperature ranged from 66°F. to 74°F. at the time of the survey. The gradient is moderate throughout most of the course. The south fork discharges a considerable amount of mining silt into the main Clearwater, and part of this material settles to the bottom as the stream gradient decreases in the lower section, forming a heavy layer of silt during the low water period. The effect of this deposit upon salmon is not known. There were approximately 380,000 sq. yd. of suitable spawning area in the main stream constituting 7 percent of the stream bed.

The diversion dam of the Washington Water Power Company is located approximately 4 miles above the mouth, and is about 40 feet high. The fish ladder at this dam as originally constructed was ineffective for chinook salmon because of its poor location at the extreme end of the dam where there was little attraction for fish, and also because at low water stages the river channel was almost dry from the diversion dam to the power plant tailrace approximately 1½ miles downstream. The operation of this dam for 13 years without adequate provision for the passage of fish is responsible more than any other single factor for the present depletion of the salmon runs in the Clearwater River system. An additional ladder was constructed at the diversion dam in 1940, and a ladder also was built from the tailrace to the forebay of the power plant. During the period of the operation of the dam before these improvements were made only the lower 2½ miles of the river, containing less than 2 percent of the total suitable spawning area in the entire main stream, were available at low water stages.

The Clearwater has great potential value as an anadromous fish producer, which could be realized if the fishways in conjunction with the Clearwater dam were further improved and if the area were restocked.

9A. Potlatch Creek.— (Sept. 15-18,1938; Parkhurst and Morton.) Potlatch Creek enters the main Clearwater River approximately 15 miles above the mouth. The stream is about 50 miles long, of which the lower 22½ miles were surveyed. Above the terminus of the survey the stream bed is composed largely of bedrock and boulders, the gradient becomes steep, and there is little spawning area. The stream had an

average width of 60 feet in the section surveyed. The survey was conducted at extreme low water stage, when more than half of the stream bed was dry. The run-off is rapid and of short duration, the stream exhibiting great fluctuation in water level. The water temperature ranged from 76°F near the mouth to 70°F at the upper terminus of the survey. The gradient is slight in the lower section, and becomes moderate to steep above. There were approximately 40,000 sq.yd. of suitable spawning area, constituting 8 percent of the total bottom in the section surveyed. However, the entire stream bed was covered with a layer of silt and algae, which together with the high water temperatures and other adverse factors causes the stream to be unsuitable for salmon. No salmon were seen or reported. The upper section may be of some value to steelhead and resident trout.

9B. North Fork, Clearwater River.— (Sept. 19-Oct. 3, 1938; Hanavan, Parkhurst, Wilding, and Morton.) The North Fork enters the Clearwater River approximately 43 miles above the mouth. The stream is about 135 miles long, of which the lower 110 miles were surveyed. Above the terminus of the survey it is of little potential value to salmon because of the steep gradient. The width of the stream ranged from approximately 400 feet at the mouth to about 100 feet at the mouth of Kelly Creek, the terminus of the survey. The discharge at the time of the survey ranged from about 1,000 c.f.s. at the mouth to 200 c.f.s. just above the mouth of Kelly Creek. Gaging station records for the years 1926 to 1948, taken at a station near Ahsahka, Idaho, 2 miles above the mouth, show discharges ranging from a maximum flood of 100,000 c.f.s. in December, 1933, to a minimum of less than 250 c.f.s. in January, 1937. The average discharge for a 19 year period (1926-1945) was 5,144 c.f.s., according to U.S. Geological Survey records. The water temperature ranged from about 65°F. in the lower section of the river to 52°F. in the headwaters. The gradient is moderate for the most part, and becomes fairly steep in the upper section. There are numerous good shallow riffle areas and adequate resting pools well distributed throughout the course. Factors that greatly reduce the potential value of the stream for salmon include the large amount of bedrock in the stream bed, especially above the confluence of the Little North Fork, and the large amount of sand in the lower portion of the river. There were approximately 250,000 sq. yd. of suitable spawning area constituting 2½ percent of the total bottom in the section surveyed.

There was a log jam 1,200 yards long about 20 miles above the mouth which was a barrier at low water. Above this point there were two smaller log jams, likewise impassable at low water. These jams develop each summer as a result of the method of logging. They are removed at high water, when the accumulated logs are floated downstream. There are no permanent barriers to the migration of fish.

The North Fork formerly supported a large run of chinook salmon. This run has been greatly depleted for many years, and is now practically exterminated. No salmon were seen or reported during the survey. A small spring run of steelhead trout was reported. The river is of little value at present as a salmon producer, but it has

good potential value.

9B-(1). Cranberry Creek.-- (September 23, 1938; Parkhurst and Morton.) Cranberry Creek enters the North Fork approximately 21½ miles above the mouth. It was discharging about 10 c.f.s. at the time of the survey. The stream is capable of supporting a small run, and is utilized by a few steelhead trout.

9B-(2). Reeds Creek.-- (September 25, 1938; Parkhurst and Morton.) Reeds Creek enters the North Fork approximately 29 miles above the mouth. The stream was 30 feet wide at the mouth, and was discharging about 50 c.f.s. at the time of observation. It contains good salmon spawning area, and is probably utilized by steelhead trout.

9B-(3). Swamp Creek.-- (September 25, 1938; Parkhurst and Morton.) Swamp Creek enters the North Fork approximately 30 miles above the mouth. The stream was discharging about 5 c.f.s. at the time of observation. It was extremely muddy and appeared unsuitable for salmon or trout.

9B-(4). Falls Creek.-- (September 26, 1938; Parkhurst and Morton.) Falls Creek enters the North Fork approximately 35 miles above the mouth. The stream was discharging about 10 c.f.s. at the time of observation. A 12 foot falls near the mouth renders it inaccessible to migratory fish.

9B-(5). Silver Creek.-- (September 26, 1938; Parkhurst and Morton.) Silver Creek enters the North Fork approximately 39½ miles above the mouth. The stream was discharging about 10 c.f.s. at the time of observation. It has a fairly steep gradient, with numerous cascades, and only a small amount of suitable salmon spawning area.

9B-(6). Gold Creek.-- (September 26, 1938; Parkhurst and Morton.) Gold Creek enters the North Fork approximately 41½ miles above the mouth. The stream was discharging about 15 c.f.s. at the time of observation. It has a moderate gradient, and contains some good salmon spawning area. Gold Creek could support a small run, and is utilized by a few steelhead trout.

9B-(7). Robinson Creek.-- (September 27, 1938; Parkhurst and Morton.) Robinson Creek enters the North Fork approximately 44½ miles above the mouth. The stream was discharging about 5 c.f.s. at the time of observation. It has a moderate gradient, and a small amount of good spawning area. It was reported that salmon had been observed in Robinson Creek in earlier years. However, the stream could accommodate only a small number of spawning salmon.

9B-(8). Little North Fork.-- (September 27, 1938; Parkhurst and Morton.) The Little North Fork enters the North Fork approximately 46 miles above the mouth. The stream was about 200 feet wide at the mouth at the time of observation, and was discharging about 150 c.f.s. The stream is about 40 miles long, and contains a large amount of

excellent spawning area. It is the best appearing salmon stream of all the tributaries to the North Fork, and was reported to have formerly supported good runs of chinook salmon and steelhead trout.

9B-(9). Thompson Creek.— (September 27, 1938; Hanavan and Wilding.) Thompson Creek enters the North Fork approximately 59½ miles above the mouth. The stream was discharging about 8 c.f.s. at the time of observation. It has a steep gradient and is of little possible value to salmon.

9B-(10). Isabella Creek.— (September 28, 1938; Hanavan and Wilding.) Isabella Creek enters the North Fork approximately 62½ miles above the mouth. The stream was discharging about 15 c.f.s. at the time of observation. It could support a small run of salmon, and is of some slight possible value to steelhead trout.

9B-(11). Beaver Creek.— (September 28, 1938; Hanavan and Wilding.) Beaver Creek enters the North Fork approximately 63½ miles above the mouth. The stream was discharging about 20 c.f.s. at the time of observation. It could support a fair run of salmon, and at present is of value to a small run of steelhead trout.

9B-(12). Skull Creek.— (October 1, 1938; Hanavan and Wilding.) Skull Creek enters the North Fork approximately 71 miles above the mouth. The stream was discharging about 35 c.f.s. at the time of observation. It could support a fair run of salmon, and at present supports a small run of steelhead trout.

9B-(13). Quartz Creek.— (October 1, 1938; Hanavan and Wilding.) Quartz Creek enters the North Fork approximately 73 miles above the mouth. The stream was discharging about 20 c.f.s. at the time of observation. It could support a fair run of salmon, and at present supports a small run of steelhead trout.

9B-(14). Little Washington Creek.-- (October 1, 1938; Parkhurst and Morton.) Little Washington Creek enters the North Fork approximately 82½ miles above the mouth. The stream was discharging about 5 c.f.s. at the time of observation. The gradient is steep, and the stream is impassable to salmon.

9B-(15). Dead Horse Creek.-- (October 1, 1938; Parkhurst and Morton.) Dead Horse Creek enters the North Fork approximately 83 miles above the mouth. The stream was discharging about 5 c.f.s. at the time of observation. It is of some possible value to a few steelhead trout.

9B-(16). Dead Mule Creek.-- (October 1, 1938; Parkhurst and Morton.) Dead Mule Creek enters the North Fork slightly more than 83 miles above the mouth. The stream was discharging about 5 c.f.s. at the time of observation. It has a fairly steep gradient, and is impassable to fish at low water stages.

9B-(17). Washington Creek.— (October 1, 1938; Parkhurst and Morton.) Washington Creek enters the North Fork about 84½ miles above the mouth. The stream was discharging about 30 c.f.s. at the time of observation. It is passable to fish only in the lower ¼ mile. Above that point the gradient becomes too steep and the stream is obstructed by log jams. The lower section is of some potential value to salmon, and may be utilized by a few steelhead trout.

9B-(18). Cave Creek.— (October 2, 1938; Parkhurst.) Cave Creek enters the North Fork about 86 miles above the mouth. It was discharging about 5 c.f.s. at the time of observation. The gradient is steep, and the stream bed is composed chiefly of large rubble. The stream was considered impassable, and of no value to migratory fish.

9B-(19). Siwash Creek.— (October 2, 1938; Parkhurst.) Siwash Creek enters the North Fork approximately 87½ miles above the mouth. It was discharging about 5 c.f.s. at the time of observation. The gradient is steep and the stream is considered impassable. It is of no value to migratory fish.

9B-(20). Orogrande Creek.— (October 2, 1938; Morton.) Orogrande Creek enters the North Fork about 92½ miles above the mouth, at the Bungalow Ranger Station. It was discharging about 15 c.f.s. at the time of observation. The gradient is generally moderate. The stream is of some present value to steelhead trout and of potential value to salmon.

9B-(21). Sprague Creek.— (October 3, 1938; Morton.) Sprague Creek enters the North Fork approximately 94 miles above the mouth. It was discharging about 8 c.f.s. at the time of observation. The gradient is steep. The stream is of slight possible value to steelhead, and of no value to salmon.

9B-(22). Squaw Creek.— (October 3, 1938; Morton.) Squaw Creek enters the North Fork about 95 miles above the mouth. It was discharging about 10 c.f.s. at the time of observation. The gradient is steep. The stream is of slight possible value to steelhead, and of no value to salmon.

9B-(23). Jackknife Creek.— (October 3, 1938; Morton.) Jackknife Creek enters the North Fork approximately 97 miles above the mouth. It was discharging about 8 c.f.s. at the time of observation. The gradient is steep. The stream is of slight possible value to steelhead, and of no value to salmon.

9B-(24). Weitas Creek.— (October 3, 1938; Morton.) Weitas Creek enters the North Fork approximately 97 miles above the mouth. It was discharging nearly 100 c.f.s. at the time of observation. The gradient is steep throughout the course, the stream draining an extremely mountainous portion of the Clearwater National Forest.

Because of its turbulent nature, the heavy run-off from melting snows, and the great amount of large rubble in the stream bed, it does not appear to be of much value to migratory fish.

9B-(25). Death Creek.-- (October 3, 1938; Parkhurst.) Death Creek enters the North Fork approximately 100 miles above the mouth. It was discharging about 5 c.f.s. at the time of observation. The gradient is steep, and the stream bed is composed chiefly of large rubble. The stream was considered impassable, and of no value to migratory fish.

9B-(26). Fourth of July Creek.-- (October 3, 1938; Wilding.) Fourth of July Creek enters the North Fork approximately 101 miles above the mouth. It is a good size stream, although smaller than Weitas Creek. Due to its extremely turbulent nature, it was not possible to measure the discharge by our field method. Because of the steep gradient, the large amount of bedrock and boulders in the stream bed, and the heavy run-off from melting snows, the stream was considered to be of little possible value to migratory fish.

Several other streams were examined above Fourth of July Creek. The uppermost stream observed was Kelly Creek, 9B-(27), approximately 110 miles above the mouth. All of them belong in the category of turbulent mountain streams of little or no possible value to migratory fish. However, most of the tributaries to the North Fork of the Clearwater maintain good resident trout populations.

9C. Orofino Creek.-- (September 21, 1938; Hanavan and Wilding.) Orofino Creek enters the Clearwater River approximately 47 miles above the mouth. The stream is about 30 miles long, of which the lower 5 miles were surveyed. It had an average width of about 25 feet in the lower section at the time of observation, and was discharging about 10 c.f.s. In the upper section the stream narrows to a width of only 6 feet. The water temperature ranged from 64°F to 62°F. The gradient is moderate in the lower section and becomes increasingly steep in the upper mile surveyed. The survey was terminated at a series of impassable falls 6 feet to 12 feet in height. The stream bed is composed chiefly of large rubble. There were 3,150 sq. yd. of suitable spawning area, constituting only 4 percent of the total stream bed in the section surveyed. The stream was considered to be of little possible value to migratory fish.

9D. Jim Ford Creek.-- (September 20, 1938; Hanavan and Wilding.) Jim Ford Creek enters the Clearwater River approximately 51 miles above the mouth. The stream was discharging only 2 c.f.s. at the time of observation. It was considered to be of little possible value to migratory fish.

9E. Lolo Creek.-- (September 20, 1938; Hanavan and Wilding.) Lolo Creek enters the Clearwater River approximately 56 miles above the mouth. The stream was discharging 10 c.f.s. on the date of observation. No detailed survey was made.

9F. South Fork, Clearwater River.— (September,1938; Hanavan and Wilding,) The South Fork joins the Middle Fork to form the main Clearwater River at Kooskia, Idaho, approximately 75 miles above the mouth. The South Fork also is about 75 miles long. A power dam about 21 miles upstream, near Grangeville, Idaho, is provided with a poor fish ladder, and is considered a barrier to the upstream passage of fish. Gaging station records taken just below the powerhouse near Grangeville for the period 1910-1916 and 1923-1948 show a maximum recorded flood of 12,600 c.f.s. in May, 1948. The minimum recorded flow according to U.S. Geological Survey published reports was 41 c.f.s. in November, 1931. The average discharge for 26 years was 803 c.f.s.

The South Fork was extremely turbid at the time of survey, due to gold dredging operations. Because of the lack of visibility it was impossible to evaluate the spawning area. The disruption of the stream bed by gold dredges and the resultant heavy silting throughout most of the stream may be harmful to the production of both salmon and trout.

9G. Middle Fork Clearwater River.— (October 6-7,1938; Parkhurst and Morton.) The Middle Fork joins the South Fork to form the main Clearwater River at Kooskia, Idaho, approximately 75 miles above the mouth. The stream is 24 miles long, and is formed by the confluence of the Lochsa and Selway Rivers. It is accessible to migratory fish throughout the course. At the time of the survey the stream was 375 feet wide at the mouth, and maintained an average width of more than 300 feet in the lower 10 miles. Discharge measurements are not recorded for the Middle Fork. However, gaging station records kept by the U.S. Geological Survey for the Lochsa and Selway Rivers, plus our estimated flows for the minor tributaries entering below the recording stations indicate a discharge at the mouth of the Middle Fork of approximately 1,100 c.f.s. at the time of the survey. The water temperature ranged from 56°F to 58°F. The gradient is moderate throughout, with numerous good shallow riffles and adequate resting pools. The stream appears to present excellent conditions for the production of salmon and steelhead trout. There were approximately 620,000 sq. yd. of suitable spawning area, constituting 19 percent of the total stream bed. No salmon were seen, but a spring run of steelhead trout was reported. The stream is of little value at present to anadromous fish, but it has great potential value for salmon and steelhead trout.

9G-(1) Lochsa River.— (October 8-9,1938; Hanavan, Parkhurst, Morton, and Wilding.) The Lochsa and the Selway Rivers join to form the Middle Fork of the Clearwater approximately 24 miles above the mouth of the latter stream. The Lochsa is approximately 75 miles long, of which the lower 15 miles were surveyed. The stream extends through the Nez Perce, Clearwater, and Lolo National Forests. There are few roads reaching the river, and most of its course is through a wilderness area practically unmolested by man. The stream had an average width of 140 feet in the section surveyed, and was discharging 403 c.f.s. at a U.S. Geological Survey gaging station lo-

cated about a mile above the mouth. The gradient is moderate in the section surveyed. There is little good spawning area because of the preponderance of large rubble, which covers about 60 percent of the stream bed. The stream is of little or no present value to salmon, and appears to be better adapted to resident trout. A few trout were observed, and the stream is of some possible value to steelhead.

The tributaries in the section surveyed are all small, flowing less than 5 c.f.s. They all have steep gradient, and are of no value to salmon.

9G-(2). Selway River.— (October 7-8,1938; Hanavan and Wilding.) The Selway and the Lochsa Rivers join to form the Middle Fork of the Clearwater approximately 24 miles above the mouth of the latter stream. The Selway is approximately 100 miles long, of which the lower 21 miles were surveyed. The stream extends through the Nez Perce and Bitterroot National Forests and the Selway-Bitterroot Primitive Area. Most of the stream course is through a wilderness area practically unmolested by man. The stream had an average width of about 150 feet in the section surveyed, and was discharging 546 c.f.s. at a U.S. Geological Survey gaging station located slightly more than 8 miles above the mouth. Good spawning areas are not extensive in the section surveyed because of the fairly steep gradient in many places and the preponderance of large rubble, which covers more than 50 percent of the stream bed.

Selway Falls is located approximately 20 miles above the mouth. This is a series of three falls, the highest being 7 feet. They are passable to spring run steelhead trout, but would be difficult or impassable for any summer chinook salmon. However, the Selway is of little present value to salmon, although it is of some possible value to steelhead and also supports a good resident trout population.

There are a number of minor tributaries in the section surveyed. Most of these are too small to be listed, discharging less than 5 c.f.s. They all have steep gradients, and are of no value to salmon, although several of them have some possible value for steelhead trout.

9G-(2)a. O'Hara Creek.— (October 7, 1938; Hanavan.) O'Hara Creek enters the Selway River about 8 miles above the mouth. It was discharging about 15 c.f.s. at the time the survey. The stream is of some possible value to steelhead as well as to resident trout.

9G-(2)b. Glover Creek.— (October 8, 1938; Wilding.) Glover Creek enters the Selway River about 17 miles above the mouth. It was discharging about 7 c.f.s. at the time of the survey. The gradient is steep, and the stream was considered impassable and of no value to migratory fish.

9G-(2)c. Gedney Creek.— (October 8, 1938; Hanavan.) Gedney Creek enters the Selway River about 19½ miles above the mouth. It was discharging about 15 c.f.s. at the time of the survey. The Idaho State Department of Fish and Game places racks across the stream at the mouth in order to capture trout for artificial propagation. It is a

good appearing trout stream, and is of much more value to resident trout than it might be for salmon.

9G-(2)d. Meadow Creek.-- (October 8, 1938; Hanavan.) Meadow Creek enters the Selway River about 21 miles above the mouth. It was discharging about 25 c.f.s. at the time of the survey. It is a good appearing stream, of considerable value to resident trout. Since it is above Selway Falls on the Selway River it is inaccessible to salmon at low water stages.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream and Type of Obstruction or Diversion	Height in Feet	Diversion in c.f.s.	Existing Protective Devices
CLEARWATER RIVER, Power dam	40	4,200	Fishways
Falls Creek, falls	12	-	
Orofino Creek, falls	6-12	-	
South Fork, Power dam			Fishway-poor
Selway River, falls	7	-	

PART 3

SUB-AREA GRANDE RONDE RIVER SYSTEM

Introduction

The Grande Ronde River joins the Snake River at Rogersburg, Washington, approximately 170 miles above the mouth. The stream extends through the southeastern corner of Washington for the lower 36½ miles, and then through northeastern Oregon for approximately 160 miles. Its drainage area comprises approximately 4,000 square miles, and includes the northern slope of the Wallowa Mountains, as well as a portion of the Blue Mountains.

The Grande Ronde River system was formerly an important producer of three species of salmon; chinook, blueback, and silver, as well as steelhead trout. The value of the system to these species was recognized at an early date by the Oregon Fish Commission when suitable locations were being sought for the establishment of salmon hatcheries. In the annual report of the Oregon State Department of Fisheries for the year 1901 the Grande Ronde is referred to as "One of the greatest salmon breeding feeders that the Columbia ever had. * * * While the river is frequented apparently so generally by the salmon for spawning purposes, still it is a very hard stream to contend with and offers few desirable locations on the lower river, where fish cultural work could be carried on successfully." This observation was proved correct,for the early records of hatchery work on the Grande Ronde River and its principal tributary, the Wallowa River, recount the terrific difficulties encountered, such as trouble installing and maintaining racks to stop the fish, and hatchery water supplies freezing during the winter months. As a result of such operational difficulties these hatcheries never produced the number of fish that the size of the runs would cause one to expect; the largest egg-take was about 4 million chinook from 709 spawners and 7½ million silvers from 2,655 spawners, taken in the year 1902 on the lower Grande Ronde near the mouth of the Wenaha River.

The runs of salmon into the Grande Ronde River have been greatly depleted in recent years and artificial propagation of salmon has been practically discontinued.

Despite its present depleted condition, the Grande Ronde River system is capable of supporting large runs of salmon, and is of great potential value to migratory fish. The greater portion of the main stream and many of its tributaries extend through sparsely settled, almost barren areas where there is little possibility of agricultural or industrial developments that would interfere with the runs of fish.

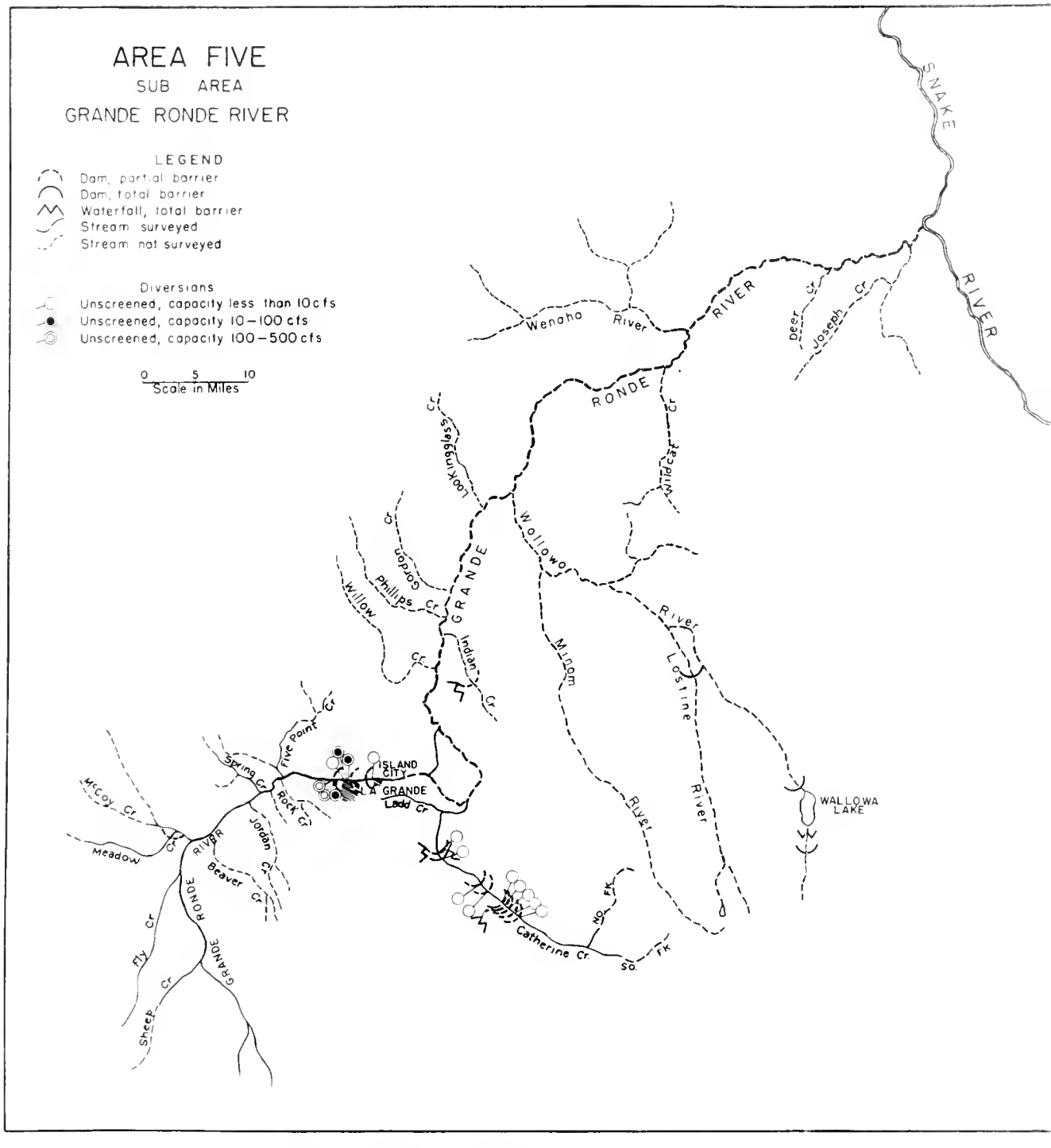


Figure 5.--Grande Ronde River System.

List of Streams

Figure 6.--Lower section of Grande Ronde River, looking downstream from bridge at Troy, Oregon.

The Survey

13. Main Grande Ronde River.-- (October 9-17, 1940, Parkhurst and Frey; and August 10-20, 1941, Parkhurst, Frey, Bryant, and Zimmer.) The Grande Ronde River extends for about 200 miles through several physiographic regions, each having distinctive stream characters, before reaching its source in the Blue Mountains of the Whitman National Forest in eastern Oregon. Its general direction of flow is northeast.

In the lower section the river flows for a distance of approximately 90 miles through a deep, narrow canyon which gradually recedes upstream. Vegetation is sparse, and the stream is subject to rapid fluctuations in volume. The stream had an average width of about 150 feet in this section on October 10, 1940, and was discharging 698 c.f.s. at a point 81 miles above the mouth, just downstream from the mouth of the Wallowa River. Gaging station records of the U.S. Geological Survey for the 19 year period 1926-1945, taken at the same point, show discharges ranging from a maximum of 22,400 c.f.s. in March, 1932, to a minimum of 225 c.f.s. in December, 1935. The average discharge at the same station and for the same period was 1,867 c.f.s. The stream gradient is moderate, with numerous shallow riffle areas and an adequate number of resting pools. There are no obstructions or water diversions in this lower portion of the river. There were a few silver salmon spawners in the lower river at the time of the survey, but the number of these fish could not be estimated because of the turbid condition of the water. This section is capable of supporting large runs of chinook and silver salmon.

The middle portion of the river extends for a distance of about 60 miles, from a point 6 miles below Elgin, Oregon, up to LaGrande, Oregon. In the lower part of this section the river extends for a distance of 8½ miles through the fertile Elgin valley, which is 4 miles or more in width and highly cultivated. This portion of the river maintains a fairly moderate gradient, and offers extensive spawning areas. The river extends through a narrow, rocky gorge from 2 miles to 4 miles above Elgin. This small canyon contains a large amount of bedrock in the stream bed, and is of no value to salmon. Above the canyon the Grande Ronde valley opens into an extensive floodplain 10 miles to 15 miles wide and about 50 miles long. The river meanders through this flat valley section up to Island City, Oregon, 2 miles below LaGrande. The gradient in this section is extremely slight, the flow often being imperceptible. The stream bed is composed almost entirely of mud and clay, and is worthless to migratory fish. The volume of flow in about 27 miles of this meandering portion of the stream is greatly reduced by the State ditch, which was cut across a huge bend of the river in order to prevent flooding during high water stages. There is little or no flow in the slough-like portion of the river cut off by the State ditch above the mouth of Catherine Creek. At the time of observation,

August 20, 1941, the river was discharging 42 c.f.s. at a point 2½ miles upstream from LaGrande. Gaging station records of the U.S. Geological Survey for a total of 31 years, taken at or near the same point, show discharges ranging from a maximum of 8,880 c.f.s. in March, 1932 to a minimum of 3.9 c.f.s. in August, 1940. The average discharge for the same period was 345 c.f.s. From Island City upstream to the upper end of the valley just above LaGrande, a distance of about 4 miles, the river loses its sluggish character and the gradient becomes fairly moderate. On August 20, 1941, the river had an average width of only 20 feet in this section and there was a large amount of exposed stream bed, due to the numerous water diversions and the natural low water conditions at this season. Below the lowermost diversion at Island City the river was reduced to a flow of less than 2 c.f.s. There were approximately 80,000 square yards of potential spawning area in this section, of which less than 10 percent was considered suitable because of flow conditions, and also because of the large amount of silt deposited as a result of the operation of two gravel dredges in the stream bed.

There are several obstructions and diversions located between Island City and LaGrande. The first of these is a debris jam at Island City, probably impassable to fish at low water stages. Approximately one mile above Island City there is a power diversion dam about 3 feet high which is considered impassable at low water. The diversion at this point amounts to 6 c.f.s., and furnishes power to a flour mill at Island City. There are several small irrigation pumps about 1½ miles above Island City that operate only intermittently. Approximately two miles above Island City there is a stone diversion dam 2½ feet high which is a barrier at low water. This dam diverts a maximum flow of about 25 c.f.s. into the Caviness irrigation ditch. About 350 yards upstream from the Caviness ditch the May Park irrigation ditch withdraws a maximum flow of about 20 c.f.s. Approximately three miles above Island City the Nessley Irrigation Ditch withdraws about 6 c.f.s. About four miles above Island City there is an old irrigation ditch, which was not in use at the time of observation. About 250 yards farther upstream there is a rock dam 2½ feet high, which is a barrier to fish at low water. On August 20, 1941, this dam was diverting about 20 c.f.s. into the LaGrande irrigation ditch. The ditch also supplies water to a slaughter house and a lumber mill in LaGrande, which necessitates a fairly large, constant diversion. None of the water diversions on the Grande Ronde River is provided with any fish protective devices. This has undoubtedly contributed to the present depleted condition of the runs of migratory fish.

Figure 7.--A section of the upper Grande Ronde River, to show damage to stream bed caused by mining dredge operation.

The upper section of the river extends from LaGrande for a distance of about 50 miles upstream. From LaGrande up to the mouth of Meadow Creek, a distance of about 25 miles, it extends through a very narrow, steep-walled valley. In the lower 6½ miles of this section, up to the mouth of Five Point Creek, the spawning area is only of fair quality, since the stream bed contains a large amount of bedrock and large rubble. The Orodell irrigation diversion is located about 50 yards upstream from the old road bridge in LaGrande, or 250 yards above the LaGrande ditch. The low stone dam in connection with this diversion is not a barrier to fish. The Gekler irrigation diversion is located 50 yards upstream from the Orodell ditch. The diversion dam is on a side channel, and is not an obstruction to fish. Above the mouth of Fivepoint Creek the quality of the spawning area begins to improve. Above Meadow Creek the valley opens to a width of 4 to 6 miles, and the river exhibits almost continuous excellent spawning area for a distance of 2 miles up to Starkey, Oregon. A short distance above Starkey the valley becomes increasingly narrow, and the stream gradient increases, although it is still classed as moderate. Several tributaries enter about 10 miles above Starkey, and the flow in the main stream above this point was reduced to 5 c.f.s. at the time of the survey. About 14 miles above Starkey there are three log and debris jams at 100 yard intervals, all impassable to fish at low water. Good spawning areas continue for a distance of 15 miles above Starkey. At this point the stream bed has been literally torn up by a gold dredge and deposited as conical mounds of gravel tailings. This upheaval continues for a distance of two miles upstream. At the time of observation, on August 10, 1941, the flow was entirely beneath the surface of the stream bed in this two mile section, due to the former dredging operation. There is also a debris jam at the lower end of the mining tailings that is impassable at low water. The principal bad effect of the gold dredging operation has been the excessive silting of the excellent spawning areas farther downstream. In the main stream above LaGrande there are approximately 250,000 sq. yd. of suitable salmon spawning area, constituting 23 percent of the total main stream bed in this section. Since the salmon runs in the upper Grande Ronde river had been already depleted to the point of extinction, the mining operations cannot be blamed for their present condition. However, any attempt to reestablish a run of salmon in the upper portion of the river would encounter serious difficulties if such mining operations are continued. The stream extends for a distance of only five miles above the upper end of the mine tailings to its source at Grande Ronde lake. This is a very small body of water near the crest of the Blue Mountains at an elevation of more than 7,000 feet. The stream is very small in the uppermost five miles, and the gradient is so steep that it is of no possible value to migratory fish.

13A. Joseph Creek.— (Not surveyed) Joseph Creek enters the Grande Ronde River approximately 4½ miles above the mouth. It extends for a distance of about 60 miles through a deep canyon to its source

on the northern slope of the Wallowa Mountains. It is the only tributary to the Grande Ronde River below the mouth of the Wenaha River that is of possible significant value to salmon. A lengthy pack trip is required in order to make a fisheries evaluation of the stream.

13B. Shumaker Creek, 13C. Deer Creek, 13D. Buford Creek, 13E. Rattlesnake Creek, 13F. Cottonwood Creek, 13G. Bear Creek, and 13H. Medicine Creek.-- (October 15, 1940; Parkhurst and Frey.) These are all short streams entering the Grande Ronde River 16 to 31 miles above the mouth. The largest, Cottonwood Creek, was discharging about 5 c.f.s., and the smallest, Medicine Creek, had practically no flow at the time of observation. They are alike in that all have low flows during the late summer and fall months; all have fairly steep gradients, and their stream beds are composed chiefly of large rubble. Except for a few steelhead trout that may enter several of them at high water, they are of no value to migratory fish.

13I. Wenatchee Creek.-- (October 15, 1940; Parkhurst and Frey.) Wenatchee Creek enters the Grande Ronde River approximately 36 miles above the mouth. It is about 15 miles long, and was discharging about 20 c.f.s. at the time of the survey. The gradient is fairly steep, but the stream contains some good spawning area and appears to be of possible value to both salmon and steelhead trout.

13J. Grouse Creek.-- and 13K. Bear Creek.-- (October 15, 1940; Parkhurst and Frey.) These two small streams enter the Grande Ronde River approximately 39 miles and 44 miles above the mouth, respectively. Both were discharging less than 1 c.f.s. at the time of observation. They are of no possible value to salmon.

13L. Wenaha River.-- (October 15, 1940; Parkhurst and Frey.) The Wenaha River enters the Grande Ronde River approximately 45½ miles above the mouth. The main stream extends for a distance of approximately 17 miles to the principal forks. In addition, the north fork extends approximately 8 miles, the south fork approximately 11 miles, and there are several other good sized tributaries. The stream was 41 feet wide near the mouth, and was discharging about 110 c.f.s. at the time of observation. The gradient is moderate, with numerous shallow riffles and a large amount of suitable spawning area. The Wenaha formerly supported a small run of chinook salmon and a fair run of silver salmon. The Oregon State Department of Fisheries maintained an egg-taking station in the years 1901 and 1902 at the mouth of the Wenaha, where both the Grande Ronde and Wenaha Rivers were racked. In 1903 the station was moved several miles up the Wenaha River, where eggs were taken from 25 chinook and 483 silver salmon (Annual Report for 1903, Oregon State Department of Fisheries). No further fish cultural work was attempted on the Wenaha, this work being transferred to the Wallowa River. Small runs of silver salmon and steelhead trout are reported as still ascending the Wenaha, and the stream appears to be of considerable potential

value to these species.

13M. Courtney Creek, 13N. Mud Creek, 13O. Wildcat Creek, 13P. Cabin Creek, 13Q. Sickfoot Creek, 13R. Grossman Creek, 13S. Elbow Creek, and 13T. Bear Canyon Creek.— (October 15, 1940; Parkhurst and Frey.) These are all short streams entering the Grande Ronde River 46½ miles to 66½ miles above the mouth. Wildcat Creek, entering 53½ miles above the mouth, appears to be the best for migrating fish. The stream was discharging about 7 c.f.s. at the time of observation. The gradient is moderate, with some good spawning area. It was reported that a run of steelhead trout enters the stream in February and March. Lower Wildcat Creek was considered at one time by the Oregon State Department of Fisheries as a possible water supply for a salmon hatchery on the Grande Ronde River. In common with the other small streams listed, it is of littlevalue to salmon.

13U. Wallowa River.— (October 12-17, 1940; Parkhurst and Frey.) The Wallowa River is the principal tributary of the Grande Ronde. It enters the latter stream 81½ miles above the mouth, and extends for a distance of approximately 55 miles. Measurements taken at a fairly low water stage, on October 14, 1940, at a point about 10 miles above the mouth, and below all major tributaries, gave a stream width of about 150 feet and a discharge of approximately 320 c.f.s. The mean minimum and mean maximum flows at the same point for the period 1903-1914 ranged from 272 c.f.s. to 5,153 c.f.s., with an average mean flow of 1,174 c.f.s. (Water Resources of the State of Oregon). The gradient is moderate to fairly steep throughout, with numerous shallow riffles and abundant excellent spawning area, but few good resting pools.

The Oregon State Fish Commission established a salmon and steelhead eyeing station on the Wallowa River in the year 1903 at a point about 8½ miles above the mouth. A hatchery was built at this location in the year 1905, but operations were greatly hampered by extremely cold weather during the late fall and winter. The annual reports of the Oregon State Fish Commission indicate that the best yearly egg-takes at this station for the various species amounted to somewhat over 2 million chinook eggs, 4 million silverside eggs, and 1 million steelhead eggs. This station was closed in the year 1913, due to the continued decline in the number of salmon entering the stream and trouble with the water supply during the winter months. In the years 1921-1922 a hatchery with an excellent spring water supply was established farther upstream, near Enterprize, Oregon. Since the year 1935 this station has been operated mainly by the Oregon Game Commission for the propagation of trout. Large numbers of the landlocked form of blueback salmon, locally termed "Yanks", also are propagated at this station.

There are numerous irrigation diversions on the Wallowa River, but no dams or other obstructions below the outlet of Lake Wallowa that might interfere with the upstream migration of fish. At the time of the survey none of the water diversions was screened to prevent the loss of fish. This condition has been one of the chief causes for the depletion of the runs of salmon in the Wallowa, and has been recognized as such in the annual reports of the Master Fish Warden of Oregon as early as the year 1901. Two of the principal water diversions are located near the town of Wallowa, approximately 23 miles above the mouth. The lower of these was withdrawing about 20 c.f.s. for irrigation at the time of observation. The upper diversion was withdrawing 70 c.f.s. for industrial purposes, the larger portion of this being returned to the river about 1 mile downstream. In addition to a number of small diversions throughout the course, there are four large irrigation diversions and one power diversion occurring in the 2 mile section between the town of Joseph and Lake Wallowa. These diversions take the greater part of the flow in the main stream above Joseph during the late summer and fall months.

The Granger Canal is located approximately 1½ miles below the dam at the outlet of Lake Wallowa. The irrigation diversion flow ranges from 0 to about 300 c.f.s.

The Big Bend Canal is located about 1½ miles below the dam at the outlet of Lake Wallowa. The irrigation diversion flow ranges from 0 to about 120 c.f.s.

The Farmers Canal is located a short distance below the dam at the outlet of Lake Wallowa. The irrigation diversion flow ranges from 0 to about 150 c.f.s.

The Silver Lake Ditch is located at the Lake Wallowa dam. The irrigation diversion flow ranges from 0 to about 130 c.f.s., and amounted to about 9 c.f.s. at the time of observation on October 12, 1940.

The dam at the outlet of Lake Wallowa was built in the year 1929. It is of concrete construction, 40 feet high, and is a total barrier to the upstream migration of fish. On the lower side of the dam there is a diversion leading to the power plant at Joseph. The diversion flow ranges from 0 to about 50 c.f.s., but is usually less than 10 c.f.s. The regulated flow in the stream bed directly below the dam ranges from 0 when there is no irrigation demand and water is being impounded, to a maximum of more than 500 c.f.s. during the high water stages in May, June, and July (Water Resources State of Oregon). There is a stationary screen located 200 feet above the dam, completely across the outlet of Lake Wallowa, for the purpose of preventing the young land-locked blueback salmon from passing downstream. The dam has resulted in the destruction of a large part of the run of blueback salmon that formerly ascended to Lake Wallowa, and the land-locking of the remainder. The good runs of chinook and silver salmon and steelhead trout that formerly utilized the

Wallowa River and many of its tributaries have been greatly depleted. The stream has great potential value to salmon, but it is useless to attempt to re-establish these runs unless the young fish are safeguarded from the numerous open water diversions.

Lake Wallowa is located approximately 50 miles above the mouth of the Wallowa River. The lake is about 3½ miles long and 1 mile wide, and has a reservoir capacity of about 41,000 acre-feet. It formerly provided an excellent rearing area for blueback salmon. There is little liklihood that the lake will ever again be accessible to anadromous fish, its chief values now being as a recreational area and as a reservoir for irrigation and power uses.

The Wallowa River extends for approximately 1 mile above Lake Wallowa, where it is formed by the confluence of the west and east forks. The flow at the forks ranges from a minimum of about 16 c.f.s. to a maximum of about 700 c.f.s. This portion of the river is of some value to land-locked blueback salmon and resident trout.

13U-(1). Howard Creek.— (Not surveyed) Howard Creek enters the Wallowa River 2 miles above the mouth. It is a small stream, about 10 miles long, and is of little present value to salmon, although it may be utilized to some extent by steelhead trout.

13U-(2). Minam River.— (October 14, 1940; Parkhurst and Frey.) The Minam River is one of the principal tributaries of the Wallowa, and enters the latter stream approximately 10 miles above the mouth. It extends for a distance of about 45 miles to its source at Minam Lake. The lower portion of the stream extends through a very narrow valley, which becomes a steep walled canyon upstream as the topography becomes increasingly mountainous. The stream was slightly more than 100 feet wide near the mouth, and was discharging about 150 c.f.s. at the time of the survey. Flow records for the years 1912-1914 show that the discharge never drops below 100 c.f.s., and at high water stages may exceed 4,000 c.f.s. (Water Resources of the State of Oregon). The stream gradient is moderate to fairly steep, with numerous shallow riffles and an abundance of excellent spawning area in the lower section, but few good resting pools. There is an earth dam 10 feet high at the source, giving Minam Lake a reservoir capacity of 1,000 acre-feet. This high, mountainous, headwater portion of the stream is of no possible value to migratory fish. The stream was reported formerly to have supported good runs of chinook and silver salmon and steelhead trout. Like the condition in the entire Wallowa system, these runs have been greatly depleted, the steelhead maintaining itself somewhat better than the other species. The Minam River is of great potential value in any possible program for the rehabilitation of the runs of anadromous fish in the Grande Ronde and Wallowa River systems.

13U-(3). Big Canyon Creek.— (October 14, 1940; Parkhurst and Frey.) Big Canyon Creek enters the Wallowa River approximately 11½ miles above the mouth, and extends for a distance of about 20 miles. It was discharging about 5 c.f.s. at the time of the survey, and was reported to become nearly dry at times in late summer. The stream

has a moderate gradient and excellent spawning areas. It is of some possible value to migratory fish except at low water stages.

13U-(4). Dry Creek.— (October 14, 1940; Parkhurst and Frey.) Dry Creek enters the Wallowa River approximately 19 miles above the mouth. It was 40 feet wide near the mouth and discharging about 50 c.f.s. at the time of the survey. It is normally a small stream, the high discharge being accounted for by the return flow from a large irrigation diversion originating on the Wallowa River and joining Dry Creek a short distance above the mouth. The gradient is moderate, and the stream contains some excellent spawning area, but because of the low natural flow in late summer above the irrigation return it was considered to be of little possible value to salmon.

13U-(5). Bear Creek.— (October 16, 1940; Parkhurst and Frey.) Bear Creek enters the Wallowa River near the town of Wallowa, approximately 22 miles above the mouth, and extends for a distance of about 25 miles. It had an average width of 15-20 feet, and was discharging about 15 c.f.s. at the time of the survey. Gaging station records indicate that the flow during the water-year usually ranges from a minimum of about 6 c.f.s. to a maximum of about 550 c.f.s., with a mean yearly flow of about 100 c.f.s. (Water Resources of the State of Oregon.) There are several small irrigation diversions in the upper section of the stream. The gradient is moderate, and there are some excellent spawning areas. Because of the low volume of flow at the time of the chinook salmon migration in July and August the stream is of little potential value to this species, but it is attractive to steelhead trout at higher water stages.

13U-(6). Whiskey Creek.— (October 16, 1940; Parkhurst and Frey.) Whiskey Creek enters the Wallowa River approximately 24½ miles above the mouth. It is a small stream, discharging less than 1 c.f.s. at the time of the survey, and is of no possible value to salmon.

13U-(7). Lostine River.— (October 16, 1940; Parkhurst and Frey.) The Lostine River is one of the principal tributaries of the Wallowa, and enters the latter stream approximately 26½ miles above the mouth. It extends for a distance of about 30 miles, the upper part of the course being through extremely rugged terrain. Its source is in Minam Lake, at the opposite end of the lake from the source of the Minam River. The stream had an average width of 34 feet, and was flowing at the rate of 62 c.f.s. at a station 10 miles above the mouth on the date of observation. Gaging station records for the years 1912-13 and 1928-45, taken at the above station, show discharges ranging from a maximum of 2,540 c.f.s. in May 1913, to a minimum of 10 c.f.s. in November 1936. The average discharge for 18 years was 175 c.f.s., according to U. S. Geological Survey records. The gradient is moderate to fairly steep, with numerous shallow riffles and an abundance of excellent spawning area. There are a number of small irrigation diversions in the lower section of the stream. Most of these withdraw about 2 c.f.s., and none is provided with fish protective devices. There is a domestic water supply dam 3½ feet high

located 1 mile above the town of Lostine, or approximately 7 miles above the mouth. This dam is not provided with a fishway, and is passable to fish only at high water stages. The water diversion is supplied by means of a well at one side of the dam, and does not greatly reduce the flow. The Lostine River formerly supported good runs of salmon, and it was reported to be of some present value to steelhead trout. It is of considerable value to resident trout, and also has a greater potential value for anadromous species.

13U-(8). Parsnip Creek.— (Not surveyed.) Parsnip Creek enters the Wallowa River approximately 30 miles above the mouth. It is a small stream, and becomes almost dry in late summer. It is of no possible value to salmon.

13U-(9). Trout Creek.— (October 12, 1940; Parkhurst and Frey.) Trout Creek enters the Wallowa River about 2 miles downstream from the town of Enterprise, or approximately 41 miles above the mouth. It was discharging about 10 c.f.s. at the time of the survey, but the flow is greatly reduced during the late summer. The gradient is moderate, and there is some good spawning area. Because of its small size at the season of the chinook salmon spawning migration, the stream is of little possible value to this species.

13U-(10). Prairie Creek.— (October 16, 1940; Parkhurst and Frey.) Prairie Creek enters the Wallowa River near Enterprise, Oregon, approximately 41½ miles above the mouth. The stream extends for a distance of about 15 miles through the upper part of the flat Wallowa Valley. The gradient is slight through the greater part of the cultivated portion of the watershed, and the stream bed contains a large amount of mud and sand. The stream was 27 feet wide near the mouth, and was discharging about 30 c.f.s. at the time of the survey. Two large irrigation diversions originating on the Wallowa River a short distance downstream from Lake Wallowa discharge their return flows into Prairie Creek, accounting for the relatively high volume of flow in the lower section. The stream contains some spawning area, but does not appear to be altogether suitable for salmon. It is formed by a number of small tributaries near the head of Lake Wallowa, all of which are too small to be of value to salmon.

13U-(11). Hurricane Creek.— (October 17, 1940; Parkhurst and Frey.) Hurricane Creek enters the Wallowa River a short distance above the mouth of Prairie Creek, near the town of Enterprise. The stream is about 18 miles long, and has an average width of 25 feet. The gradient is moderate to fairly steep, with numerous shallow riffles, adequate resting pools, and excellent appearing spawning areas. Water measurements taken at a point approximately 8 miles above the mouth, upstream from all diversions, indicated a flow of about 60 c.f.s. at the time of the survey. Records show that the flow at this point ranges from a minimum of about 10 c.f.s. to a maximum of about 500 c.f.s. (Water Resources of the State of Oregon.)

There is a concrete irrigation diversion dam located about 8 miles above the mouth. This dam is 10 feet high, and is a barrier to fish. The ditch was estimated to be withdrawing more than 30 c.f.s. at the time of the survey. Approximately 100 feet farther upstream there is another low irrigation diversion dam diverting about 5 c.f.s. During the late summer there is often no flow in the stream bed below the lower dam, all the water being taken for irrigation. For this reason Hurricane Creek is of no possible value to salmon.

13U-(12). West Fork, Wallowa River.— (October 17, 1940; Parkhurst and Frey.) The West Fork joins the East Fork to form the main Wallowa River approximately 1 mile above Lake Wallowa. It extends for about 10 miles with a steep gradient through extremely mountainous terrain to its source in several high mountain lakes. The stream was 30 feet wide near the forks, very turbulent, and flowing at an estimated rate of about 100 c.f.s. at the time of the survey. A waterfall 30 feet in height is located about ½ mile above the mouth. The short stream section below the falls is of some value to land-locked blueback salmon. The greater portion of the stream is of value only to resident trout.

13U-(13). East Fork, Wallowa River.— (October 17, 1940; Parkhurst and Frey.) The East Fork joins the West Fork to form the main Wallowa River about 1 mile above Lake Wallowa. It is a small, turbulent stream extending for a distance of about 5 miles to its source in a high mountain lake. An impassable power dam 8 feet in height is located 1¼ miles above the forks. At the time of the survey the flow just above the power diversion was 11 c.f.s., of which 6 c.f.s. were being delivered to the power plant 1 mile downstream, and 5 c.f.s. were being by-passed. The tailrace of the power plant discharges into the West Fork ¼ mile downstream. Gaging station records of the U. S. Geological Survey for the years 1924-45, taken at a station ¼ mile above the mouth and 1 mile below the power diversion show discharges ranging from a maximum flood of 300 c.f.s. in July, 1937, to a minimum of 0.1 c.f.s. (regulated) in December, 1929. The average discharge for the 21-year period was 11.9 c.f.s. Gaging station records taken at the power plant tailrace over the same period of years show discharges ranging from a maximum of 17 c.f.s. to periods of no flow. The power plant average discharge for the 21-year period of record was 7.56 c.f.s.

The East Fork is of little possible value to fish other than a few resident trout in the upper section.

13V. Lookingglass Creek.— (October 9, 1940; Parkhurst and Frey.) Lookingglass Creek enters the Grande Ronde River approximately 85 miles above the mouth. It extends for a distance of about 16 miles to its source in several springs. The stream was 43 feet wide near the mouth, and was discharging approximately 80 c.f.s. at the time of the survey. The gradient is moderate, with numerous shallow riffles, good resting pools, and an abundance of excellent spawning area. The watershed is uninhabited, and there are no obstructions or water demands on the stream.

Numerous springs along the course and in the headwaters assure a constant minimum flow. There are two hatchery sites on the stream, one just above the mouth and the other at the mouth of Little Lookingglass Creek. No information was obtainable on the present size of the runs of anadromous fish into the stream, but they are undoubtedly depleted, in common with the entire Grande Ronde system. Lookingglass Creek is one of the best appearing smaller streams in the system, and is of potential value to anadromous fish.

13V-(1). Little Lookingglass Creek.— (October 10, 1940; Parkhurst and Frey.) Little Lookingglass Creek enters Lookingglass Creek approximately 3½ miles above the mouth and extends for a distance of about 20 miles, including its two main branches. It was 24 feet wide near the mouth, and was discharging approximately 20 c.f.s. at the time of the survey. The stream branches at a point 1½ miles above the mouth, both forks remaining large enough for several miles to accomodate migratory fish. Logging operations on the watershed may lower the minimum sustained flow. The gradient is moderate, with almost continuous good shallow riffles and excellent spawning areas. At the time of the survey the stream appeared to be of some potential value for small runs of migratory fish.

13W. Cabin Creek.— (October 10, 1940; Parkhurst and Frey.) Cabin Creek enters the Grande Ronde River approximately 87 miles above the mouth and extends for a distance of about 12 miles, including its two main branches. It was 9 feet wide near the mouth, and was discharging about 3 c.f.s. at the time of the survey. The stream branches at a point 1½ miles above the mouth, neither fork being large enough to be of value to salmon. The gradient is moderate, with numerous shallow riffles and excellent spawning areas. Cabin Creek is of little possible value to salmon, but it may be utilized by steelhead trout at higher water stages.

13X. Gordon Creek.— (October 10, 1940; Parkhurst and Frey.) Gordon Creek enters the Grande Ronde River approximately 94 miles above the mouth. It is a small stream, discharging less than 1 c.f.s. at the time of the survey. Because of its low flow during the late summer and fall months the stream is of no possible value to salmon.

13Y. Phillips Creek.— (October 9, 1940; Parkhurst and Frey.) Phillips Creek enters the Grande Ronde River near the town of Elgin, approximately 96 miles above the mouth. The lower section of the stream was completely dry at the time of observation. For this reason it is of no possible value to salmon.

13Z. Clark Creek.— (October 10, 1940; Parkhurst and Frey.) Clark Creek enters the Grande Ronde River near the town of Elgin, approximately 96 miles above the mouth, and extends for a distance of about 30 miles, including its two main branches. The north fork and the middle fork of Clark Creek enter about 5 miles and 5½ miles above the

Figure 8.--Fishway and diversion dam for the City of Union domestic water supply, on Catherine Creek.

mouth, respectively. Neither of these branches nor the main stream above their confluence maintains a sufficient flow to be of value to salmon. Clark Creek was discharging about 5 c.f.s. at the mouth at the time of the survey. The lower two-mile section of the stream has a moderate gradient and good spawning areas. About 3½ miles upstream from the town of Elgin there is a low wing dam, passable to fish, and a small irrigation diversion. Clark Creek is too small to be of any significant value to salmon, although at higher water stages it may be of some value to steelhead trout.

13AA. Indian Creek.— (October 9, 1940; Parkhurst and Frey.) Indian Creek enters the Grande Ronde River approximately 98 miles above the mouth and extends for a distance of about 22 miles. The stream was 8 feet wide at the mouth and was discharging about 4 c.f.s. at the time of the survey. It has a moderate gradient and good spawning areas. The town of Elgin maintains a domestic water supply dam and diversion at a point about 5½ miles above the mouth. This dam is 9 feet high, and is provided with a poor fish ladder, which is impassable at low water stages. It was reported that no salmon enter Indian Creek during the fall months, but that a few (probably steelhead trout) ascend during the spring high water period. The stream does not maintain a sufficient flow during the late summer and fall to be of any possible significant value to salmon.

13BB. Willow Creek.— (October 9, 1940; Parkhurst and Frey.) Willow Creek enters the Grande Ronde River approximately 101 miles above the mouth and extends for a distance of about 20 miles through a highly cultivated region. The stream was 15 feet wide near the mouth and was discharging about 20 c.f.s. at the time of the survey. It has a very slight gradient, a stream bed composed almost entirely of mud and sand, and no suitable spawning area. Willow Creek is of little or no possible value to salmon.

13CC. Catherine Creek.— (August 9-13, 1941; Frey and Bryant.) Catherine Creek enters the Grande Ronde River approximately 135 miles above the mouth. The main stream is about 30 miles long, of which only the lower 9 miles are accessible to migratory fish at all times. The gradient is very slight in the lower section, and the stream bed in the lower 12 miles is composed entirely of mud and sand, with no suitable spawning area. In the next 3 miles upstream the stream bed is so heavily silted as to be of no value as salmon spawning area. Above the town of Union, located about 16 miles above the mouth, the gradient increases and suitable spawning areas are found. Water measurements taken at the time of the survey indicated a flow of about 21 c.f.s. at a point about 10 miles above the mouth. Due to irrigation diversions, the flow was much greater farther upstream. Measurements taken at a point about 25 miles above the mouth indicated a flow of 68 c.f.s. Gaging station records of the U. S. Geological Survey, taken at a station about 22 miles above the mouth, show flows ranging from a maximum flood of 1,740 c.f.s. in May, 1948, to a minimum of 4 c.f.s. in

Figure 9.--A wire-covered rock irrigation diversion dam on Catherine Creek.

November, 1930. The average discharge for 21 years was 116 c.f.s. The water temperature at the time of the survey ranged from 74°F. near the mouth to 59°F. in the headwaters.

There were 19 dams on the main stream, 11 of which were at least barriers at low water stages, and several of these partially obstructed the passage of salmon even at high water. There were 29 water diversions on the main stream, of which only one, the intake to the hatchery of the Oregon State Game Commission, was actually screened. The only other screen was a grizzly with 1-inch spacing at the intake to the flour mill in the town of Union.

There are several factors that have made conditions in Catherine Creek unfavorable for the production of anadromous fish. The first and most important of these is the effect of the dams and water diversions previously mentioned. While the dams might be provided with fishways and the diversions screened, the extensive withdrawal of water for irrigation, industrial, and domestic use cannot be avoided. This often does not leave a sufficient volume of flow in the stream bed at the time of the upstream migration of salmon. Second, the water temperature becomes abnormally high in late summer, often above 80°F. Such temperatures are not conducive to the successful propagation of salmon or trout. It was reported that for this reason fish could not be held at the state trout hatchery later than the month of June. These high temperatures are due to the exposure of the stream bed resulting from water diversions, and the removal of timber in the headwaters. Third, flash floods have become increasingly frequent occurrences. For example, on August 19, 1941, a cloudburst on the middle fork brought down a sudden 5-foot high flood of thick, muddy water. A local resident reported that when the crest had passed he counted 40 dead adult salmon in a half-mile section of the stream bordering his ranch. Such occurrences are also very damaging to salmon and trout eggs and fry. These excessive floods are due mainly to the removal of timber in the upper section of the watershed. Under these conditions the stream is of little value in the production of salmon.

The former good run of chinook salmon into Catherine Creek has been greatly depleted. Twenty salmon spawners were counted during the survey, but visibility was poor due to the turbidity of the water. The run of steelhead trout has maintained itself much better, a fair run of this species still ascending to the headwaters during the spring high water stages.

13CC-(1). Mill Creek.— (August 13, 1941; Frey and Bryant.) Mill Creek has two outlets; one discharging directly into the Grande Ronde River, and the other discharging into Catherine Creek at a point 1 mile above the mouth. It is normally a small stream, about 10 miles long, and flows through a highly cultivated region. The gradient is slight in the lower section, and the lower 3½ miles of the stream bed

consist entirely of mud. Suitable spawning area first appears about ½ mile below the village of Cove. A small power dam at Cove is a total barrier to migratory fish. A few steelhead trout ascend to the power dam, but chinook salmon are not reported to enter. The stream is used extensively for irrigation, and is of little possible value to anadromous fish.

13CC-(2). Ladd Creek.— (August 11, 1941; Frey and Bryant.) Ladd Creek enters Catherine Creek about 6½ miles above the mouth. It is a small stream, about 15 miles long, extending through a highly cultivated region. The gradient is slight throughout most of the course, and the stream bed is composed chiefly of mud. In the upper third of the course, where the gradient is moderate and the stream bed is composed of gravel, the flow is only 2-3 c.f.s., and the stream is too small to be of value to salmon.

13CC-(3). Little Creek.— (August 12, 1941; Frey and Bryant.) Little Creek is a small, intermittent stream entering Catherine Creek about 10½ miles above the mouth. It extends for about 14 miles, and is used so extensively for irrigation that water must be diverted from Catherine Creek into the lower part of the course. In the lower section the gradient is slight and the stream bed is composed of mud. Several irrigation diversion dams are barriers to the migration of fish. The stream is too small in the upper section to be of any possible value to salmon.

13CC-(4). Pyle Creek.— (August 12, 1941; Frey and Bryant.) Pyle Creek is a small, intermittent stream entering Catherine Creek about 11½ miles above the mouth. It discharges only 1-2 c.f.s. during the summer months, most of the flow being used for irrigation. The gradient is slight, and the stream bed is composed chiefly of silt. The stream is of no possible value to salmon.

13CC-(5). Little Catherine Creek.— (August 13, 1941; Frey and Bryant.) Little Catherine Creek enters Catherine Creek approximately 25 miles above the mouth and extends for a distance of about 7 miles. It is a small stream, the average discharge during the summer being only about 5 c.f.s. One-fourth mile above the mouth the stream emerges from a narrow canyon having a steep gradient, numerous log and debris jams, and little suitable spawning area. The lower quarter-mile has some spawning area, and may be utilized by a few salmon in years when the stream is not too shallow for them to enter. The lower section is also of some possible value to steelhead trout.

13CC-(6). North Fork, Catherine Creek.— (August 9, 1941; Frey and Bryant.) The North Fork enters Catherine Creek approximately 29 miles above the mouth and extends for a distance of about 11 miles. The stream was 21 feet wide near the mouth, and was discharging about 28 c.f.s. at the time of the survey. It is not a particularly good appearing salmon stream, the gradient being steep and the stream bed

containing a considerable amount of large rubble. About 10 percent of the stream bed was classified as suitable spawning area. The first obstructions were two recently formed log jams located about 3 miles and 3½ miles above the mouth. These and several other log and debris jams farther upstream caused by road building operations were at least barriers to fish at low water stages, and probably limited the migration of salmon. A fair sized run of chinook salmon formerly ascended as far as the confluence of the middle fork, approximately 3½ miles above the mouth, and steelhead trout ascended much farther upstream. These runs, especially the salmon, are now greatly depleted. During the survey three chinook salmon spawners were observed about one mile above the mouth, and a small spring run of steelhead trout was reported. The North Fork is of slight present value as a salmon producer, but its potential value would be increased by the removal of log and debris jams.

13CC-(6)a. Middle Fork, Catherine Creek.— (August 9, 1941; Bryant.) The Middle Fork enters the north fork of Catherine Creek approximately 3½ miles above the mouth and extends for a distance of about 5 miles. The stream had an average width of 6 feet near the mouth, and was discharging about 5 c.f.s. at the time of the survey. The gradient is steep, with numerous cascades and there is little suitable spawning area. Like the north fork, it has been filled with log and debris jams resulting from road building and logging operations, which impede the passage of fish. The stream is now also blocked to salmon ascending at low water stages by jams on the north fork. It formerly supported a small run of chinook salmon, but is of no present value to salmon. A few steelhead trout are reported to ascend at high water stages.

13CC-(7). South Fork, Catherine Creek.— (August 9, 1941; Frey.) The South Fork enters Catherine Creek approximately 29 miles above the mouth and extends for a distance of about 9 miles. The stream had an average width of 15 feet near the mouth, and was discharging about 27 c.f.s. at the time of the survey. The gradient, although steep, is less than that of the other branches of Catherine Creek. It was estimated that 13 percent of the stream bed consisted of suitable spawning area, which was a larger amount than that found in any of the other tributaries. There are numerous log and debris jams, many being impassable to fish at low water stages. The South Fork formerly supported the largest runs of chinook salmon and steelhead trout of the three branches of Catherine Creek. These runs have been greatly depleted in recent years, principally because of obstructions in both Catherine Creek and the South Fork. The stream is of little present value to salmon, but retains some value for a spring run of steelhead trout. Its potential value to anadromous fish could be greatly increased by the removal of log and debris jams.

13DD. Fivepoint Creek.— (August 15, 1941; Parkhurst.) Fivepoint Creek enters the Grande Ronde River 6½ miles above the town of LaGrande, or approximately 156½ miles above the mouth. There was an appreciable flow in only the lower 2 miles at the time of the survey. The stream was 12 feet wide near the mouth, and was discharging about 2½ c.f.s. Fivepoint Creek formerly maintained a higher minimum flow, and supported small runs of salmon and steelhead, as well as resident trout. It is of no present or potential value to salmon.

13EE. Rock Creek.— (August 15, 1941; Zimmer.) Rock Creek enters the Grande Ronde River less than one-quarter of a mile above Fivepoint Creek. At the time of the survey it was discharging about 2 c.f.s., and was practically dry at a point 1 mile above the mouth. The stream is of no present or potential value to salmon.

13FF. Whiskey Creek.— (August 17, 1941; Zimmer.) Whiskey Creek enters the Grande Ronde River about 9 miles above the town of LaGrande. It is a small stream, discharging about ½ c.f.s. at the time of the survey, and is of no present or potential value to anadromous fish.

13GG. Spring Creek.— (August 16, 1941; Zimmer.) Spring Creek enters the Grande Ronde River about 10 miles above the town of LaGrande. It was discharging less than 1 c.f.s. at the time of the survey, and is of no present or potential value to anadromous fish.

13HH. Jordan Creek.— (August 21, 1941; Zimmer.) Jordan Creek enters the Grande Ronde River about 11 miles above the town of LaGrande. At the time of the survey it was discharging about 2 c.f.s., and was practically dry at a point 1½ miles above the mouth. Jordan Creek formerly maintained a higher minimum flow, and supported small runs of salmon and steelhead, as well as resident trout. It is of no present or potential value to anadromous fish.

13II. Beaver Creek.— (August 21, 1941; Parkhurst.) Beaver Creek enters the Grande Ronde River about 17 miles above the town of LaGrande. The course extends for about 18 miles, of which the lower 2 miles were surveyed. The stream was 15 feet wide at the mouth, and discharging about 6 c.f.s. at the time of the survey. It decreased to a width of 8 feet and a flow of about 3 c.f.s. at a point 2 miles above the mouth, and the upper section was considered too small to be of possible value to salmon. The gradient is moderate in the lower section, with good shallow riffles, adequate resting pools, and excellent spawning areas. It was estimated that there were about 15,000 sq.yd. of suitable spawning area in the lower 2 miles, constituting 64 percent of the stream bed in that section. The entire stream is inaccessible to migratory fish at low water stages because of obstructions in the main Grande Ronde River, and is therefore of no present value for salmon production. A domestic water reservoir supplying the town of LaGrande is located in the headwaters of the stream. This structure

does not hinder fish life. Beaver Creek is of value to resident trout, and of some possible value to steelhead at high water stages. The lower section of the stream is of potential value to salmon.

13JJ. Meadow Creek.— (August 23-25, 1941; Parkhurst and Zimmer.) Meadow Creek enters the Grande Ronde River approximately 18½ miles above the town of LaGrande. The stream is about 24 miles long, of which the lower 11½ miles were surveyed. It was considered to be of no possible value to salmon above the terminus of the survey because the flow had decreased to less than 2 c.f.s. The stream was 45 feet wide near the mouth, and was discharging only about 10 c.f.s., the survey being conducted at low water stage. The gradient is moderate to fairly steep, with numerous shallow riffles comprising good spawning areas. It was estimated that there were 47,000 sq.yd. of suitable spawning area constituting 23 percent of the stream bed in the section surveyed. Numerous beaver dams were found, several constituting barriers to fish at low water. A low, temporary, loose rock dam located approximately 6 miles above the mouth was also a barrier at low water. Meadow Creek formerly supported a good run of chinook salmon. This run has been depleted to the point of extermination. The entire stream is inaccessible to anadromous fish at low water stages because of dams in the main Grande Ronde River. A fair spring run of steelhead was reported, and a few small resident trout and numerous rough fish were observed. Meadow Creek is of no present value to salmon, but with some stream improvements it would be of good potential value.

13JJ-(1). Dark Canyon Creek.— (2). McCoy Creek.— (3). Marley Creek.— (4). Burnt Corral Creek.— (5). Battle Creek.— (6). Campbell Creek.— and (7). Bear Creek.— (August 23-25, 1941; Parkhurst and Zimmer.) These are all small tributaries to Meadow Creek in the section surveyed. Their discharges ranged from ¼ c.f.s. to 2 c.f.s. at the time of the survey, McCoy Creek being the largest. None was considered of any possible value to salmon, although a few steelhead trout were reported to enter them at high water stages.

13KK. Fly Creek.— (August 14, 1941; Zimmer.) Fly Creek enters the Grande Ronde River approximately 23 miles above the town of LaGrande. It was discharging about 1 c.f.s. at the time of the survey, which was an extreme low water stage. The stream is of no possible value to salmon, but is of some slight value to resident trout, and possibly of slight value to steelhead trout at high water stages.

13LL. Sheep Creek.— (August 28, 1941; Parkhurst and Zimmer.) Sheep Creek enters the Grande Ronde River approximately 32 miles above the town of LaGrande. The stream is approximately 10 miles long, of which the lower 6 miles were surveyed. It was 15 feet wide near the mouth and was discharging about 4 c.f.s. at the time of the survey. The flow was less than 2 c.f.s. at the upper terminus of the survey. The gradient is slight to moderate, with numerous shallow riffles, good

resting pools, and excellent spawning areas. It was estimated that there were 15,000 square yards of suitable spawning area, constituting 40 percent of the total stream bed in the section surveyed. A low, wooden diversion dam located 3 miles above the mouth is a barrier to fish at low water stages. The diversion consists merely of a 6-inch pipe operated by a pump. Sheep Creek is of some value to resident trout, and also to steelhead at high water stages. It is of no present value and of slight potential value to salmon.

13MM. Limber Jim Creek.— (August 10, 1941; Parkhurst.) Limber Jim Creek enters the Grande Ronde River approximately 35 miles above the town of LaGrande. It was discharging about 2 c.f.s. at the time of the survey, which was at an extreme low water stage. The stream is of no possible value to salmon, but is of some slight value to resident trout, and also of some possible value to steelhead trout at higher water stages.

13NN. Clear Creek.— (August 10, 1941; Parkhurst.) Clear Creek enters the Grande Ronde River approximately 37 miles above the town of LaGrande, in a section where the stream bed of the main Grande Ronde has been badly torn up by gold dredges. The stream is about 8 miles long, and divides into two small branches 4 miles above the mouth. The discharge was about 3 c.f.s. at the time of the survey. Clear Creek is of some slight value to resident trout, and also of some possible value to steelhead trout at higher water stages.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream and Type of Obstruction or Diversion	Height in Feet	Diversion in c.f.s.	Existing Protective Devices
GRANDE RONDE RIVER			
Mill power dam	3	6	None
Caviness irrigation dam and diversion	2½	25	None
May Park irrigation diversion	-	20	None
Nessley irrigation diversion.	-	6	None
Irrigation diversion	-	0 (dry)	None
LaGrande irrigation dam and diversion	2½	20	None
Orodell irrigation dam and diversion	1½	15	None
Gekler irrigation dam and diversion	Low	12	None
Gold dredge tailings	3-5	-	None
WALLOWA RIVER			
Numerous small irrigation diversions	-	-	None
Irrigation diversion	-	20	None
Industrial diversion	-	70	None
Granger irrigation canal	-	0-300	None
Big Bend irrigation canal ...	-	0-120	None
Farmers irrigation canal	-	0-150	None
Silver Lake irrigation canal.	-	0-130	None
Power dam	40	0-50	Screen
MINAM RIVER			
Dam	10	-	None
LOSTINE RIVER			
Numerous small irrigation diversions	-	-	None
Domestic water supply dam ...	3½	From well	None
HURRICANE CREEK			
Irrigation dam and diversion.	10	30+	None
Irrigation dam and diversion.	Low	5	None
WEST FORK, WALLOWA RIVER			
Falls	30	-	None
EAST FORK, WALLOWA RIVER			
Power dam	8	0-17	None
CLARK CREEK			
Irrigation diversion	-	Small	None
INDIAN CREEK			
Domestic water supply dam ...	9	2	Fishway-poor
CATHERINE CREEK			
19 dams and 29 diversions ...	-	-	1 screen

(continued on next page)

TABLE OF OBSTRUCTIONS AND DIVERSIONS (continued)

Name of Stream and Type of Obstruction or Diversion	Height in Feet	Diversion in c.f.s.	Existing Protective Devices
MILL CREEK			
Power dam	Low	-	None
Several irrigation diversions	-	Small	None
LITTLE CREEK			
Several irrigation dams and diversions	Low	Small	None
PYLE CREEK			
Several irrigation diversions	-	Small	None
NORTH FORK, CATHERINE CREEK			
Several log and debris jams..	Low	-	None
MIDDLE FORK, CATHERINE CREEK			
Several log and debris jams..	Low	-	None
SOUTH FORK, CATHERINE CREEK			
Numerous log and debris jams.	Low	-	None
MEADOW CREEK			
Numerous beaver dams	Low	-	None
SHEEP CREEK			
Diversion dam	1	-1	None

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